THE

ELECTRICAL REVIEW.

VOL. LX. MAY 24, 1907. No. 1,539.

ELECTRICAL REVIEW.

Vol. LX.] CONTENTS: May 24, 1907. [No. 1,539.

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THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1907 EDITION.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.
Telephone Nos. Holborn 933; Central 4425 (Editorial only).
ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

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THE ELECTRICAL TRADE.

ELECTRICAL engineering seems never to be free from some irritating complaint or aggravating disease. One almost wonders whether there ever were good times at all. When electricity was really in its infancy it had its troubles—had to cut its teeth, to learn to toddle, to learn an alphabet—and manners. In its early teens it outgrew its clothes and got too big for its boots, for the reckless financier persuaded it to sow its wild oats, and grandmotherly governments the while lectured it and put legislative ironbands about it to keep it from expanding too well. Did it ever have really good health in all its parts at one and the same time, even during its youth? Has it ever had such since? When those too-tight garments were split they put it into sacks which have never been comfortably and profitably filled out, and in these it has gone with an unsteady floundering sort of gait ever since. The east wind of competition has been a chilling shriveller. Our manufacturing business has been subjected to operations for appendicitis—some say it must suffer again and again in this way before it will be well again. Internal troubles often have been the cause of the ill-health, but the detailed diagnosis has been too difficult. The doctors and physicians have disagreed in their findings on the matter, and men in the street have their own various versions according to their point of view.

Among other factors have been the constant changes in the science and practice of electrical engineering, which have brought endless anxieties and tribulations to the electrical manufacturer. To keep pace with new developments and change their methods so as to be in a fair measure in conformity therewith, special measures have been adopted as an imperatively necessary course by those who have wished even to survive, but this getting into line has been a costly matter, and has stopped dividends and reduced capital.

To anyone who has watched the course of the electrical trade in this country at all closely, say during a couple of decades, many unsatisfactory reflections of the foregoing order must occur as he stands and looks backward. But it is the latest bulletin that is of greatest interest—retrospective wanderings may not be freely indulged in at this juncture. The present position demands investigation, and we want to know the signs of the times and how to read them correctly. We should like to invite an expression of views from those actively connected with the industry as to the real extent of the existing evils and the possible remedies.

The price of metals is, of course, a temporary hindrance to many branches of electrical development, as stated in Callender's report, which we printed last week. The limits of the electric tramway are, perhaps, being more definitely drawn, and proposed extensions abandoned, either to give the road to the motor-omnibus, or because estimates of loca development have not been fulfilled. But the falling off in tramway work, as mentioned in the report of the Brush Co., has not been sufficiently compensated for by railway elec

trification, for that is unconscionably slow in coming. Electrical contracting seems to be going to small men—ironmongers, &c. Electricity supply is fighting against a gas competition that is keener than it ever was.

Competition between home manufacturers of electrical plant, &c., has not eased off materially; for the smaller lines of apparatus and materials a greater struggle is foretold; competition with the foreign manufacturer in this country is ever with us, and promises from all accounts to become a harder thing to deal with than before.

How about the foreign markets? Are we looking after these? We have over and over again emphasised the importance of those markets to British firms, in view of the altered and altering state of things at home. The companies that have been displaying energy and initiative far afield are being rewarded, but from information that reaches us from certain foreign markets, it is clear that the British manufacturer is not doing anything like the amount of business there that he might do, if he applied himself to the task in an enlightened and enterprising way. Take the case of South America. German firms send out their representatives armed with financial and other powers, in the exercise of which they are allowed full freedom. As we are informed, their technico-commercial and financial men in this way are enabled to secure concessions and to finance them, and their own works are benefited, while the British manufacturer fails to secure business which might be his were he to adopt a like procedure.

We know there are several of our bigger manufacturers who have done some work abroad, but it is our belief that they might be doing far more. Generally speaking, there is more profit to be obtained from contracts of this sort than is to be secured from scrambling for home contracts, which everybody says leave such a poor margin of profit. What is to prevent the British manufacturer from securing concessions and trade in our Colonies and in foreign markets? American and German competition have to be faced everywhere, but taking the position as it exists to-day, what better thing can be done than for our investors to put their money into schemes promoted by British firms who will give work to British factories? We invite the views of our readers.

Tramway Companies and the Post Office.

The Municipal Tramways Association made a political slip in approaching alone the Postmaster-General in the matter of the proposed new regulations. There was nothing at all, even in dignity, to be lost, but a great deal of added force to be gained by combination with the Tramways and Light Railways Association, and perhaps with the Association of Tramway and Light Railway Officials. They preferred to occupy an isolated position, even though an obviously important, and easily arranged, combination might have been effected. Instead of an extended and linked attack, we are spectators of an assault by sections which is not likely to give the enemy the idea that unity governs the actions of the opposing strategists.

Rumours of skirmishes and of an impending battle having reached the council of the T. and L.R.A., heralds were sent out, or, to drop a metaphor which tires, a letter was written to the P.M.G., in which he was asked to include members of the Association in the Conference which is to be held shortly by representatives of the G.P.O., the B. of T., and the M.T.A. To this the P.M.G., snatching his advantage, replies that not being sure of the movements of the main body he is not able at the present moment to give facilities for joining forces, but he will have much pleasure in smashing the T. and L. R. A. in detail if they will be good enough to name their champions. [The metaphor seems to have returned.]

"The Postmaster-General feels that a careful examination of the proposals he has made would convince those interested in tramways that they involve nothing inimical to their interests." Possibly that is quite true, but we are reminded by something in the phraseology of the methods of examination and persuasion which were employed by the Duke of Alva in the conversion of Netherlandish heretics.

We are convinced that the case against the P.M.G. could have been put much more strongly had the whole body of tramway interests been joined together; and we hope that petty jealousy, or the irreconcilable opinions which seem to be inevitable when municipalities and companies are engaged in the same work, will not in future weaken or prevent a combination against external forces which threaten the whole industry without distinction of opinion.

The Paris Lighting Question.

The settlement of the electric lighting question in Paris, to which attention was drawn in our issue of April 5th, has now been followed by the provisional constitution of the Compagnie Parisienne de Distribution d'Electricité, which is to undertake the future supply of light and power until the year 1940. The new company has M. Richemond, of the Edison Co., as president, and M. Bénac, of the Banque de Paris, and M. Villars, of the Union Parisienne, as vice-presidents. The period between next November and the end of 1913 is regarded as the transitory term, during which the new company will proceed to establish generating stations and lay cables. During that time the Sectors will continue to produce and supply energy at the reduced charge of 7 centimes per hectowatt-hour for lighting and 3 centimes for other purposes, whilst the lighting rate will be further reduced to 5 centimes in 1914. At the end of 1913 the main cables belonging to the Sectors will pass into the possession of the Municipal Council without more ado, and the latter has the right to purchase the sub-stations, distributing mains and meters, apparently for the purpose of the new company. The initial capital of the company is merely £80,000, a sum which is needed for the guarantee of the concession. The existing sectors participate to the extent of 55 per cent., and the remainder has been subscribed by the group represented by the Banque de Paris, Schneider-Mildé (Creusot) and the Société d'Electricité de Paris. After the receipt of all the official consents the company will raise the share capital to £2,000,000, and this will be increased, it is expected, to about £6,000,000 in 1914, and to £8,000,000 at a later period.

Copper.

Messrs. Merton's interesting circular of copper statistics is again to hand, and does not indicate any very marked change in the situation. Stocks are somewhat down on the showing for April 30th, the quantity in England and France and afloat being 11,603 tons, as against 12,958 at the end of the previous fortnight. The figure under supplies to England and France from Spain and Portugal is remarkably low, only 210 tons, being an equivalent quantity to that of April, 1906, when the price was only £85. Australia still shows a good output—1,900 tons.

Re-shipments are still high, 350 tons being transmitted from Liverpool and Swansea to America during the fortnight ending May 15th. There is a slight increase in the quantity afloat from Chile, being 2,100 tons, as against 1,975 for April 30th, while some of the metal afloat from Australia seems to have been delivered, the figures being 3,550 against 4,000 for April 30th.

The price is fairly firm, £102 7s. 6d., and the general tendency of the figures is in the direction of low supplies. It will be necessary to await the figures for the end of the month for confirmation, but the real activity to be expected in imports appears to be still unrealised.

Mechanical Brakes on Continental Tramcars.

The Official Circular for May of the Tramways and Light Railways Association contains a translation of the reports on brakes, which were read and discussed at the International Tramway Congress held in Milan last year. Something was said about these reports at the time, but the present juncture, at which certain Committees are holding inquiries as to the best forms of braking appliances, seems suitable for further reference to what may be regarded as a true mirror of Continental opinion. It seems to us that M. de Burlet, in opening, handled the subject with the kind of quiet, disinterested, and undogmatic force which should be applied in all controversial questions.

In speaking of the existence of two schools, one favouring an air brake, and the other in favour of an electric brake, he says that this division of opinion is not only natural, but necessary, nor is one opinion likely to efface all others at any future date, for the question of brakes is, and must remain, largely dependent on local and special conditions. On the other hand, there was an agreement upon two points: the necessity for a powerful and prompt emergency brake in addition to the ordinary service brake, quite independent of the "counter-current" brake, and having a separate apparatus; and that the ordinary service brake must fulfil the two-fold duty of acting smoothly and without straining the driver unduly.

Not alone upon the Continent, but in Great Britain also, is there a fairly general agreement in the abstract on these two points, and in this country as in those the heat of argument is spent upon the comparative efficiencies of the several species of brake, and upon the many variations included in each species. These considerations make the labours of representative committees of engineers and managers particularly acceptable, for there is some hope that their recommendations will hasten forward the time when the public will have ceased to doubt the efficacy of the service brake, and in the last resort the certainty of the emergency brake to avert calamity.

Lightning Arresters.

A discussion of the merits of the common forms of arrester took place at the March meeting of the American I.E.E., and the multi-gap arrester shunted by a resistance seems to have found most adherents, although persons who had practical experience on E.H.T. transmission lines found that heavy discharges destroyed the multi-gap arrester by welding the cylinders together. The horn arrester was criticised for its habit of shutting down plants by continuing the short circuit for a sufficiently long time to open the station circuit-breakers, although the *Street Railway Journal* of April 6th does not report anyone as condemning it for failing to protect the line and apparatus from lightning discharges. Dr. Perrine holds that the real function of the horn arrester is as an extra precaution against surges which might destroy other types of arrester. For instance, where horns are put in parallel with multi-gap arresters the latter take care of the high-frequency discharges, while those of low frequency surge over the horns.

The speaker wisely warned the meeting that it was not safe to accept experimental evidence on the non-arcing quality of any arrester, unless it was certain that the voltage of supply was maintained against the drop caused by heavy current passing the arrester. Tests were mentioned in which oscillographs showed that the initial pressure of 2,000 volts was reduced to 200 when 300 amperes passed, whereas the power behind a lightning discharge is incalculable.

The Bow Trolley.

Mr. Eugen Eichel, writing from Schenectady to the *Street Railway Journal* of March 9th, in reply to criticisms by a German engineer, justifies his preference for the trolley wheel, if not his objection to the bow, at least for heavy current collection. He explains the fact that the bow is used generally in Saxony by suggesting that it was developed for practical use in Dresden, and has been given preference, as a local product, by the Commissioner for Tramways, who has the right to decide what form of collector shall be used. Nevertheless, he admits that it gives satisfaction on low-speed small-power lines.

Before the Schuckert Co. were merged with Siemens and Halske, they issued a pamphlet which stated that in one installation the trolley wire of 8 mm. diameter was worn 0·8 mm. with the bow after nine months' running, and that a wear of as much as 1·9 mm. was observed at points of heavy current collection. Other objections are that the points of suspension of the trolley wire must be staggered to spread the wear over the surface of the bow; that special care must be taken with the erection of wire at curves in order that the bow shall not slip from under and over-ride the wire; that the collecting alloy of aluminium is so soft as to fuse apart if a short-circuit occurs in the car equipment; that the wear is very heavy if the distance between wire and rail changes frequently; and that the collecting capacity of one bow is limited to 50 amperes when running free, and to 150 amperes at starting.

All these objections have much weight in the U.S.A., where most town tramways are joined to a comparatively heavy-service country line, but they cannot be applied wholesale to British conditions. Up to the present there is no sign that the wheel is to be superseded by the bow, nor is there any probability of this change being made even by degrees, for the trolley wheel now runs at high and low speeds with surprisingly little trouble, and there is no reason to suppose that its record will get worse.

Aluminium in Italy.—An aluminium works has recently been erected near the town of Bussi in the Abruzzi, by the Roman company which for some years past has owned a 4,000-H.P. factory in the same neighbourhood for the manufacture of caustic soda, bleaching powder, &c. A new power station has been built about 4 miles distant, and is developing power from the Rivers Tirino and Pescara to the amount of 12,000 H.P. From this station current is supplied to light and serve the towns of Aquila, Chieti, and all the other places in the vicinity, and also to certain works where copper sulphate, artificial fertilisers, and nitrogen compounds are being made. The aluminium factory is to obtain some of its bauxite from the mines at Lecce dei Marsi in the province of Aquila, but the greater part will be procured from Japan.

TELEGRAPH SWITCHING: METROPOLITAN INTERCOMMUNICATION SCHEME.

In these columns we have from time to time referred to the establishment in the Central Telegraph Office, London, of a telegraph switching system, by which Metropolitan telegraph offices can be inter-connected at the Central Office. In this way telegrams originating at one Metropolitan office for another Metropolitan office can be sent direct, instead of being received in and re-transmitted by the Central Office. For example, under the existing arrangement, if Wandsworth has a message for Holloway, the former office first sends it to the Central Telegraph Office, where the message is collected from the Wandsworth circuit and taken to the Holloway circuit for retransmission. Under the intercommunication scheme, however, Wandsworth will be switched through direct to Holloway. The system is, in fact, an application of telephonic methods to meet the special telegraphic requirements of Greater London.

A small experimental switchboard installed about five years ago having proved successful, a large switchboard has recently been completed, by means of which, when all the necessary lines have been connected thereto, the whole of the offices in the Metropolitan area, with the exception of a few offices in the E.C. district served by pneumatic tubes, will be able to intercommunicate with each other. The average daily total number of transactions in the central office in telegrams between Metropolitan offices is over 50,000, and as the greater portion of this work will be sent direct from "collecting" offices to "delivering" offices, with only a switching operation at the central office, the saving in time which the new system will effect will be considerable.

When complete, the system will embrace about 550 offices. There will be approximately 330 wires to offices which only collect telegrams; 480 wires to offices which collect and deliver; about 200 wires to switch-working sets in the various divisions of the Central Telegraph Office, and 90 auxiliary direct circuits for provincial and foreign traffic at the larger branch offices during busy hours.

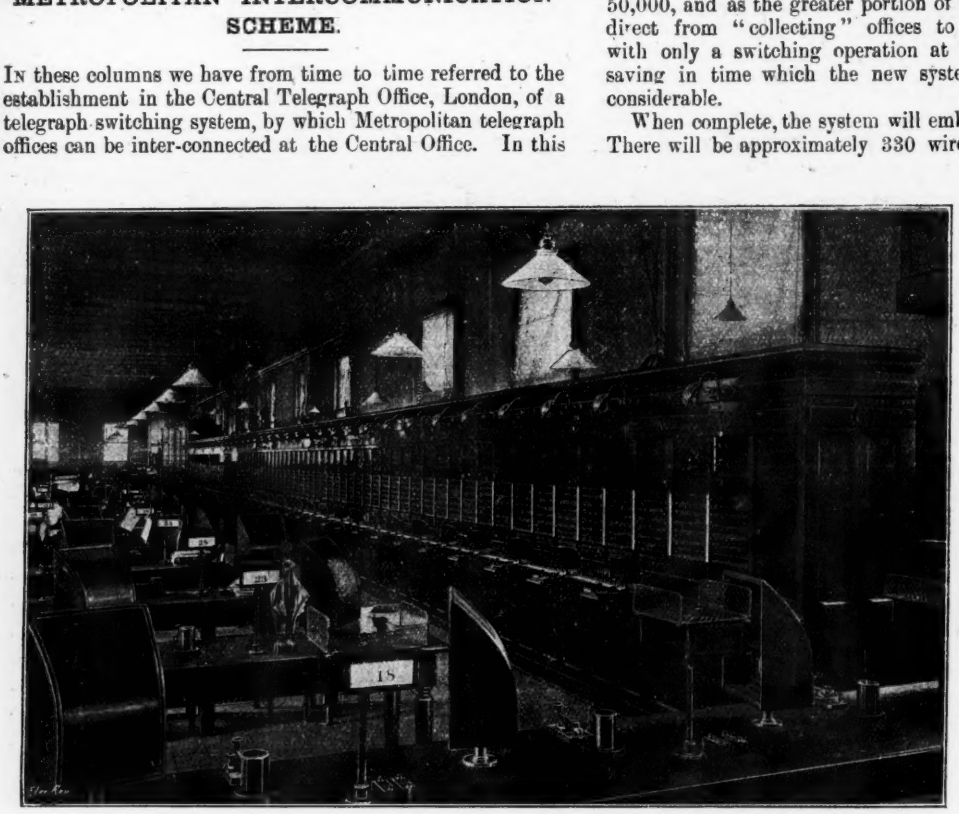

Fig. 1.—General View of Telegraph Switchboard.

The complete switchboard consists of 12 multiple sections, each having three switch operators' positions. A general view of the switchboard is shown in fig. 1, and fig. 2 gives a view of the auxiliary plant, including, in order from left to right, the test box, to which all the Metropolitan lines are connected before being taken to the switch, the fuse-board, relay racks and distribution frame, with the switch-board proper beyond.

Two types of multiple switching section have been installed. The first or "double-cord" type (figs. 3 and 4) accommodates circuits to offices which both collect and deliver telegrams. Each such circuit is connected to a switch-jack, with an "engaged" lamp immediately beneath, on the multiple panel of each of the 12 sections for outward

Fig. 2.—Test Board, Fuse Board and Relay Rack, Intermediate Distributing Frame and Switch Section.

calls, and also to a jack, with calling relay and lamp, upon the "Home section" of one panel for inward calls. The calling lamp is connected in the local circuit of the relay, and calls, indicated by the illumination of the lamp, are answered by the insertion of one peg of a pair in the home-jack, the other peg being inserted on the multiple panel in the jack corresponding to the line asked for.

The insertion of the first, or "answering" peg, joins the calling line to the cord and automatically disconnects the calling relay battery and lamp from the circuit: and the

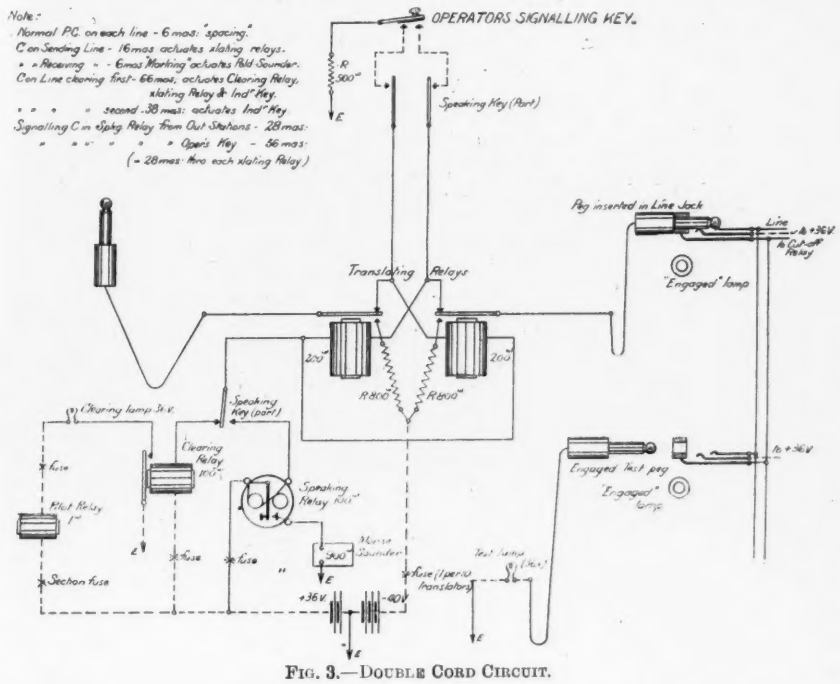

FIG. 3.—DOUBLE CORD CIRCUIT.

insertion of the second, or "calling" peg, completes the connection to the line required, and lights the "engaged" lamp corresponding to the line on all the other multiple sections, so preventing its appropriation by another operator while a through communication is passing. Each cord circuit is equipped with a listening and speaking key, by means of which a reading instrument under the control of the switch operator is brought into circuit to read the call, as well as with the transmitting relays provided for through working, and a clearing relay and lamp for the purpose of announcing to the switch-operator the conclusion of the communication.

The second or "single-cord" type of multiple section (fig. 5. p. 834) provides for lines to collecting offices which forward, but do not receive, telegrams. As other stations have no occasion to call such offices, the lines are permanently connected to single-peg cords, thus dispensing with the home-section jacks and double-peg cords which are required for offices which both forward and receive telegrams. The single cords are equipped with speaking keys, transmitting relays and a local relay with lamp, which serves the purpose of indicating both calling and clearing signals.

Lines to collecting offices are not connected to the multiple panels, but the double-cord circuits are, of course, connected to the multiple panels of single-cord switching sections, in order that a connection to any required office may be made there.

The power for the whole system is supplied from a central or common battery at the Central Office, there being no batteries of any kind at the out-offices.

The use of a common battery means the abolition of primary batteries at 350 Metropolitan offices, thus effecting considerable annual saving in battery maintenance alone.

A small permanent current normally flows from a 36-volt central battery over all the lines so long as they are open for traffic. The receiving apparatus at the out-stations is wound to a high resistance in order to reduce the permanent and working currents to a minimum. The signals sent by these stations, whether for the purpose of calling, signalling messages or clearing, are formed by increments of the normal permanent current, produced by partially or entirely short-circuiting the receiving instruments and resistance coils at the stations.

(To be concluded.)

SUPPLY COMPANIES' COMMERCIAL DEPARTMENTS.

[COMMUNICATED.]

IN view of Mr. Borlase Matthews's articles on recent developments in supply companies' commercial departments, it may be interesting to note some results due to one particular phase of this development.

Besides the energetic canvassing of a district by commercial engineers on behalf of a company, the latter has, in most cases, found it profitable to provide and install the machinery required by the customers. Together with the supply of machinery, there has usually gone a guarantee to keep the installation in continuous working order, and this guarantee has gone a long way to persuade customers to place their orders for machinery with the power company, rather than with the contractors who would merely guarantee the apparatus for a twelvemonth, and who, moreover, have no pecuniary interest in the matter after their accounts have been paid.

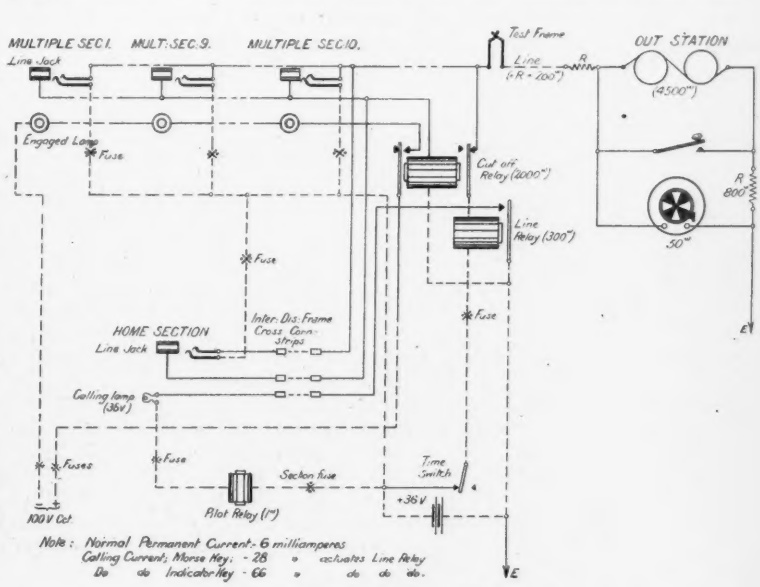

FIG. 4.—DOUBLE CORD CIRCUIT MULTIPLE.

Under such conditions, and with the above exception, the supply company would be on an ordinary commercial standing with manufacturers and contractors having offices in the area of supply.

The usual practice of a supply company is to contract for

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a period of, say, twelve months with motor manufacturers and others, the contracts being made on the basis of lowest price, other conditions being equal.

So far, there is nothing to complain about, but within recent years there has been a tendency on the part of power companies to supply apparatus to consumers at a lower price than any other manufacturer or contractor could possibly do, and sometimes at a less cost than they are actually paying themselves for the apparatus.

This practice is used as an advertisement for obtaining the order to supply power to the consumer. It, therefore,

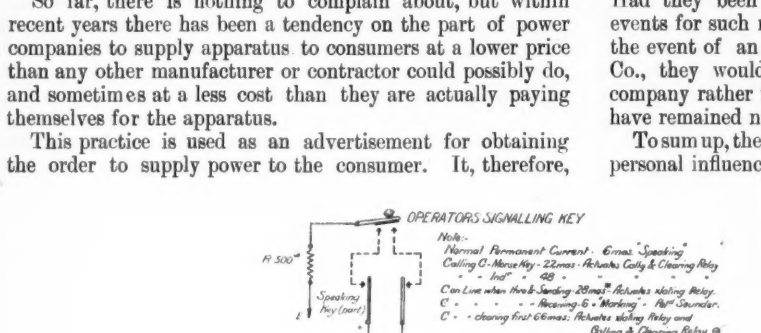

OPERATORS SIGNALLING KEY
Note:-
Normal Permanent Current:- 6 mas. "Speaking"
Calling C.-Morse Key - 22 mas - Actuates Colly & Clearing Relay
" " Ind" " 48 " " " " "
C on Line when thro' Speaking 28 mas - Actuates Visiting Relay.
C " " " " - Receiving - 6 - "Marking" - Part Sounder.
C " " clearing first 66 mas: Actuates Visiting Relay and
Calling & Clearing Relay @
Signalling C in Speaking Relay - from Out Stations - 28 mas.
" C " " " " Opers Key - 56 -
(28 mas. thro each Visiting relay)
x Of this current only ½ (7 mas) passes thro' colly & clearing
Relay which is not affected
@ The Current passing thro' Colly & Clearg Relay is 16 mas.
R 500"
Speaking Key (part)
Socket Contact
Transfering Relays
Test frame
OUT STATION
Line
(+R-200")
4500
Disconnecting Side
Speaking Side
R 800"
R 800"
Calling & Clearing Lamp 36V
Fuse
Calling & Clearg Relay 300"
Pilot Relay 1"
R 100"
Speaking Relay 100"
Morse Sounder 900"
Time Switch
Fuse
Section Fuse
+36V
-90V
E

FIG. 5.—SINGLE CORD CIRCUIT.

pays the supply company to lose a little on the installation, because it can make up all that it loses, and more beyond, in the supply of power.

Now whilst there is no law saying that a power company should not make a practice of doing this, it has an adverse effect on manufacturers and contractors in the district.

Where the area of a supply company is limited, and does not extend over more than a small radius from the power station, the results are not very serious; but where the company carries on this business within a radius of, say, 10 miles, they become so at once.

Where a company of this magnitude follows such a practice, it seriously damages manufacturers and contractors who are working that area. Whether it will in the long run pay even the supply company is doubtful, as, in spite of the fact that such power companies are springing up, and some are in existence already, they have to bear in mind that they are creating a feeling against them which is not merely competitive, and, therefore, legitimate, but resentful and damaging.

Those manufacturers who hold the contracts for supplies of material with such companies may have little to say against them at the time, but should they be so unfortunate as to lose their contract on the next tender, they are perfectly aware that their business in that area will be curtailed. Not only that, but the contractors for material to these companies cannot themselves compete in the open market with the power company, as the latter, owing to selling at less than cost price, can easily beat the manufacturers of the articles themselves.

The result, therefore, is that the contractors in the area they supply, instead of doing all they can to get consumers on the mains, especially large ones which are most profitable to the power companies, do everything they can to persuade them to put in private installations.

To the writer's knowledge a Supply Co. lost a large prospective client because certain contractors worked hand in hand to prevent his agreeing for a supply, they knowing perfectly well that in the event of his doing so they would see no order for machinery, whereas if he were kept out of the Supply Co.'s hands, at least one of them would get some orders. Had they been able to tender in the ordinary course of events for such machinery as would have been required in the event of an agreement being arrived at with the Power Co., they would have vied with each other to help the company rather than oppose them. At the worst they would have remained neutral.

To sum up, therefore, in spite of the advantage of a large staff, personal influence, and low prices for machinery, and also in spite of present success, the power companies are not doing as well as they might, if instead of trying to cut the throats of contractors they did their best to work hand in hand with them, and to compete with them on fair lines.

The supply companies and contractors are together stalking the consumer. But at the present time the contractor on his part stalks the consumer and does his level best to damage the Power Co.

It may be said that this is simply a continuation of the free-wiring idea, and no doubt this is perfectly correct, but the free-wiring method of advertisement, to the writer's mind, was itself a wrong one, though, until supply companies extended the same practice to motors and other machinery, perhaps the idea does not seem to have become recognised.

In the case of free wiring the interests affected were much smaller than in the case of heavier machinery, and the firms involved, namely, wiring contractors, had not the power to retaliate. In the case of large machinery suppliers, they may have the power to retaliate, and from instances within the writer's knowledge, it seems that they are inclined to exercise that power.

There will be no seeming objection to a modification of their practice, namely, that the Power Co. supply machinery to the customer at whatever price they choose, after putting up each contract to public tender, thus giving manufacturers as good a chance to obtain the contract as they would have had, had it been a private installation.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Radio-Telegraphic Convention.

At one of the meetings of the Select Committee of the House of Commons to consider the Radio-telegraphic Convention, Sir William Preece stated that he had been experimenting with wireless telegraphy for 12 years before Mr. Marconi came to England. The nature of these experiments was not referred to, and it seems extraordinary that none of the Committee asked Sir William what success he had achieved in so long a period.

If Sir William had in view the experiments he has carried out with telephones and wires specially erected to secure the best induction effects, they would be outside the range of an inquiry into radio-telegraphy.

Sir William's admission that he could do nothing as regards communicating with light-vessels until he had secured Mr. Marconi's coherer, would certainly make it appear that he was still working by the induction method, because his stumbling block lay in the fact that he could not erect a land-line on a ship, and that his first insight into radio-telegraphy was coincident with Mr. Marconi's arrival in England.

The lay Press has attached a good deal of importance to Sir William's experiments, and on occasion refers to him as

the inventor of wireless telegraphy ; yet it has to be shown where any invention came in in these experiments. Induction was a bugbear to telegraphists long before the telephone was introduced, and the only thing Sir William has done is to make use of it as any other person could have done who had merely to give an order for miles of land-line to be erected.

It is a great pity just at this particular time that these experiments of very trivial import should have been mixed up in any way with radio-telegraphic experiments, where every forward step has been an invention of the greatest scientific interest.

M.I.E.E.

Life in India.

On reading the article in the Electrical Review of the 10th inst., *re* "Cost of Living in India," I was considerably surprised at the "advice" given to young engineers, as to their social life.

Passing over the statements referring to "bare living" expenses, which, at £12 per month, seem very reasonable for India, and also the remarks about the natives, which are obvious, we come to the point in question.

I have a good many friends who have been, and are, resident in India (some of them having been born there), and their experience does not suggest that a gentleman must necessarily be entirely "in the swim" to obviate social extinction. I am at present resident with a gentleman who was born and lived the bulk of his life in an Indian hill-station, Darjeeling ; so he should have a fair knowledge of the case.

Mr. Shanan mentions £600 per annum as being a less comfortable salary in India, than £200 per annum in England. Taking his estimate of £144 per annum "bare living" expenses, the meagre allowance of £456 per annum is left for luxuries, &c.

But even if we allow all this, the young engineer who joins one or two clubs of various kinds, and is generally "in the swim," cannot have much pride in his profession, or he would devote more time to it. It is to be hoped, for the sake of the profession, that the young engineer will pay more attention to his duties and a little less to his social well-being.

G. P. S.

May 14th, 1907.

Wiring Cost of Small Houses.

With regard to your note in this week's issue of the Electrical Review, and the criticism on the estimate in the *West Ham Electrical Bulletin* as to the cost of wiring small houses, allow me to point out that this is not our estimate, but is an estimate published after consultation with one of the largest electrical contractors in the borough. I am quite aware that the price is low, but you will bear in mind that West Ham is not Kensington (fittings are accordingly), and this department does not hamper electrical contractors in any way with rules, regulations and red tape. We have absolutely not a single rule of our own ; all we require people to work to being the "Institution Wiring Rules," and those of the fire offices concerned. Every facility and assistance is given by the department to contractors, and if by assisting and not hampering them we are able to obtain lower prices than other districts can, it is a matter for congratulation to ourselves, and not a matter for criticism.

I suppose it sounds strange to hear of an electric supply department which does not imagine that it exists for the purpose of binding contractors body and soul, and condemning the work outright on the least pretence, but the result is low prices and good workmanship.

A. Hugh Seabrook,
Engineer and Manager.

West Ham Electricity Department,
May 17th, 1907.

[We are well aware of the progressive attitude of the department over which Mr. Seabrook presides, and the West Ham contractors are to be congratulated on the common-sense régime under which they work. If *they* are satisfied with the estimates in question, well and good !—Eds. E.R.]

Income-Tax and Depreciation.

Mr. John Pilling inquires whether, in fixing the amount of depreciation for rating purposes, it is more correct to calculate the percentage on the original value or upon the "reducing balance" principle, and I desire to express my strong opinion that the "reducing balance" principle is unsound.

Let it be agreed that a certain amount of plant, valued at £10,000, has a life of 25 years ; then it is obvious that the depreciation allowance annually should be such that the whole £10,000 would be wiped off at the end of the 25 years, and the amount, therefore, applicable to any one year is $\frac{1}{25}$th of the £10,000.

If, however, the reducing principle be adopted, the original £10,000, even at the end of a million years, would not be wiped off, as may be seen by carrying out, for a number of years, the following series of calculations :—

Original sum	£10,000
4 per cent. thereon	400
End of first year	£9,600
4 per cent. thereon	384
End of second year	£9,216
4 per cent. thereon	369
End of third year	£8,847
4 per cent. thereon	354
End of fourth year	£8,493
4 per cent. thereon	349
End of fifth year	£8,144
4 per cent. thereon	326
End of sixth year	£7,818
4 per cent. thereon	313

If the above calculations be continued for 25 years, it will be found that at the end of that period, instead of the £10,000 being wiped off, there will still be a balance to liquidate of about £3,500.

I strongly urge engineers responsible for the rating figures to insist upon an allowance for the full depreciation of the year rather than the attenuated figure which is arrived at by the "reducing balance" principle.

Robert Hammond.

Westminster, *May 8th*, 1907.

"The State and the Inventor."

Noticing the letter from Mr. B. H. Thwaite, appearing under the above title in your "Correspondence" columns, will you favour me with space for one or two remarks ?

As editor of *Transactions* to the Glasgow Technical College Scientific Society, before whom this paper was delivered on February 16th last, I regret the delay which occurred in publishing the lecture, more especially as it was in *no way* due to Mr. Thwaite, he having given me the MSS. immediately after the meeting. Reports of the lecture appeared in all the local newspapers, particularly in the *Glasgow Herald* of February 18th.

Regarding the reforms suggested by Mr. Thwaite, the generally expressed opinion of the meeting was distinctly favourable, and the published discussion, although abridged, goes to show this.

With regard to the effect of the renewal taxes, there are, of course, two directly opposing opinions held by those who interest themselves in the matter. One side holds that those taxes often cause the inventors of good patents to drop them before the idea has reached the stage of commercial development ; the other holds that the fees act as a very humane and certain executioner of only those ideas which are either useless or impracticable. And it is quite easy for both sides to cite instances to prove their respective views.

Undoubtedly, there is much to be said for both sides, and probably a system derived from both might be the better arrangement.

My suggestion is that the maximum life of a patent should be extended to 20 years ; that the preliminary payments be sufficient to keep the patent in force for 10 years from date of application ; and that at the commencement of the eleventh year renewal taxes be imposed and continued with annual increases for the remainder of the patent's life.

Such an arrangement would give the inventor, who is "ten years too soon," a reasonable period to develop his idea and obtain financial assistance, while he would not be faced with annual taxes. At the same time it would choke off the useless and impracticable ideas after a fair trial. If such a system were combined with a tribunal capable of setting aside useless patents, which were clearly blocking other progressive ideas, I am inclined to think that the most clamant grievances of the harassed inventor would be removed.

John D. Mackenzie.

Glasgow, *May 16th*, 1907.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Motor Tower Wagon, with Hydraulically-Operated Raising and Lowering Gear.

In the accompanying illustration, we show a motor tower wagon, which was recently delivered to the Southport Corporation electricity department. The raising and lowering gear, when the motor was delivered, was carried out in the usual way by hand, and necessitated two men being with the wagon, as owing to it having to pass under the trolley wires, it was necessary to raise the tower at least 7 ft. at each lamp. This work was found to be of such an exhausting character, that it was more than one man could accomplish. Mr. R. S. Downe's department, therefore, designed and fitted the hydraulic arrangements as shown on the photograph (fig. 1). The method of working is as follows:—On the driving platform a

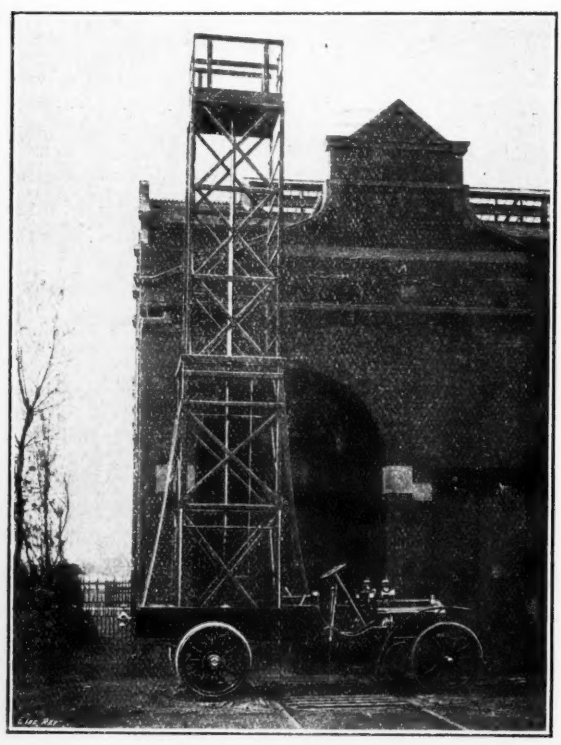


FIG. 1.

cast-iron tank is fixed beneath the coil box, and out of the way of the driver's feet. This tank contains a single-throw valveless oil pump, similar in all respects to the one supplied for the forced lubrication of engines of the enclosed type. This pump is driven by a Renold's chain from the clutch shaft. The oil from the pump is delivered to a three-way cock, which is controlled by a lever at the driver's right hand, clearly shown in the photograph. This is its normal position, and when the engine is running with the clutch in, the oil is delivered from the pump to the three-way cock and back to the tank. The pump, therefore, is always operating when the clutch is in. To raise the tower, this lever is pulled over, the oil delivered being diverted into the cylinder and raising the ram. It is found that the pressure required, as indicated on the pressure gauge fixed on the dashboard, is between 140 and 150 lb. to the square inch, and the time required for a total lift of 9 ft. 6 in. is 25 seconds.

To prevent overrunning, this lever is positively connected by bell crank levers and rods, shown on the photograph, and is engaged by a trigger when the ram is 12 in. in the cylinder. To lower, the small lever in the front, which is connected to a straight through cock, is pulled over; this opens a connection between the cylinder on the far side of the non-return valve to the tank, and enables the tower to be lowered under perfect control in a few seconds if required. An air vessel, the top of which is just distinguishable above the rear wheel, has been fixed; and although only a single-throw pump is employed, the lift is practically continuous.

The raising and lowering operations are carried out perfectly silently, and are under absolute control, the two levers being fixed in their normal positions by means of springs. The ram is $2\frac{1}{4}$ in. diameter, and the inside of the cylinder $2\frac{5}{16}$ in. The tube (supplied by a Birmingham firm) was drawn so true that the ram only required polishing. A cup leather is fitted on the top of the cylinder to prevent leakage of the oil, and is perfectly satisfactory.

The tower wagon was supplied by a local firm—the Vulcan Motor Co.—and has a four-cylinder engine developing 20 H.P.

The wheels are fitted with 3-in. solid rubber tires, twin tires being fitted to the back wheels.

In addition to using the wagon for trimming arc lamps, Mr. Downe's department find it convenient for mains testing and repairs at night.

The Trotter Universal Photometer.

To meet the want for a "Universal" photometer, with which it is possible to measure the candle-power of lamps, whether in the test room or in the street or illumination on a vertical or horizontal plane, or at any required angle, with ease and accuracy, irrespective of the colour of the light, and without a correcting constant, MESSRS. EVERETT, EDGCUMBE & CO., LTD., of 87, Victoria Street, Westminster, are introducing a photometer designed by Mr. A. P. Trotter, and here illustrated (figs. 2 and 3).

Mr. Trotter suggested an application of Crova's law as a means of eliminating the colour difficulty, Crova having found that if two lights, differing even as much in colour as daylight and an ordinary candle, are both viewed through a yellow screen, thus making them practically monochromatic, the relative illumination is thereby unchanged.

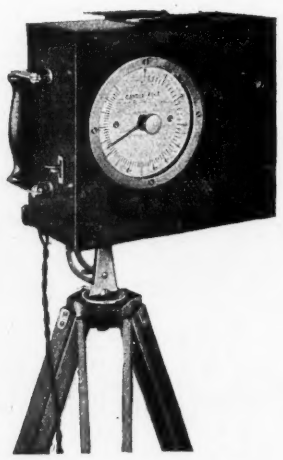


FIG. 2.

Fig. 3 shows the photometer diagrammatically. A small standard lamp L throws a beam of light which is reflected by the mirror M on to the screen S_1. This is viewed through three small slits in the screen S_2, which receives the illumination to be measured. S_1 can be rotated about its axis, and the illumination thereby varied until a balance of brightness between S_1 and S_2 is obtained. The illumination of S_2 is then read off on a direct-reading scale, 10 in. long, and graduated so as to read from 0 to 2 candle-feet. The scale is almost evenly divided throughout its length, being much more open at the lower end, so that feeble illuminations can be accurately measured. As is shown in fig. 2, the instrument is for portable use attached to a very light and strong folding tripod stand, provided with a pivoted and hinged head enabling the photometer to be turned in any direction and set at any required angle. The 4-volt battery which actuates the incandescent lamp is in a separate portable wooden case.

The colour of the light forms a convenient mean between the yellowish tint of the ordinary low-efficiency glow lamp and the whiter colour of the arc. In order, however, to make the instrument applicable to lights of every colour, specially coloured screens are provided, which can be readily substituted for either S_1 or S_2 as required.

When the photometer is levelled by means of the small plumb-bob inside the case, and a balance obtained, the horizontal illumination is given direct in candle-feet. If the illumination is required

on a vertical plane, or at any other angle, the photometer is set accordingly by means of the plumb-bob, which moves over a graduated scale, and the measurement is made as before.

If, instead of the illumination, the candle-power of the source of light is required, the screen S_2 is turned towards it, the correct

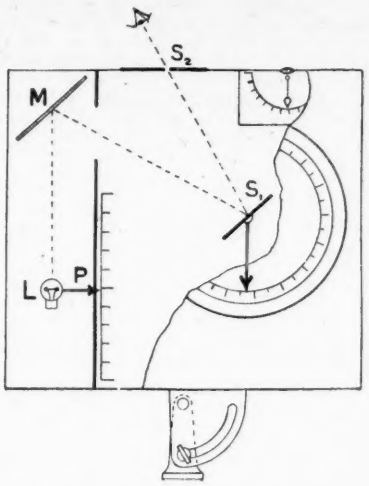


FIG. 3.

direction being determined by means of a lens and scale, and the illumination measurement is then made. This value, multiplied by the square of the distance in feet of the photometer from the light, gives the candle-power required.

"Two-Stage" Arc Lamp Lowering Gear.

Hitherto generating station lighting has mostly been done by arc lamps skied above the crane, or by incandescents or arcs on brackets on the side walls; the latter is more expensive, whilst both systems are inefficient, giving light where it is not wanted. THE LONDON ELECTRIC FIRM, by their two-stage arc-lamp lowering gear, have enabled lamps to be suspended below the line or in the wake of the crane, in the centre of the building, where the best distribution of light is obtained. Half the number of lamps hitherto used will probably suffice, thus reducing initial expenditure as well as maintenance costs. The gear, as shown in fig. 4, consists simply of a telescoping tube, fixed pendant to the plug of the well-known "one working part" arc lamp contact and suspension gear. The normal position of the lamp is below the level of the crane; when

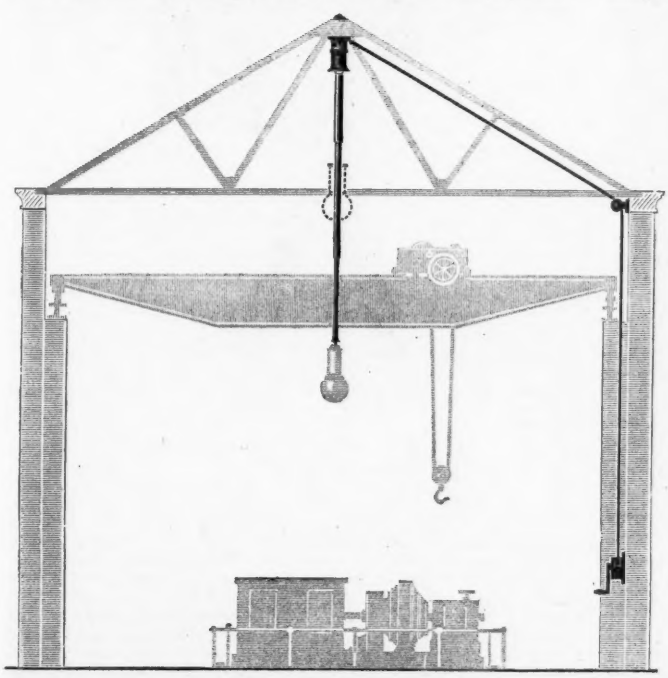


FIG. 4.

it is desired to move it to its second position, above the crane, the wire rope is drawn up, telescoping the tube and thus raising the lamp out of the way. The pendant portion of the gear is provided with a knuckle joint, so that no serious damage would be done in the event of the crane being accidentally run against it. The wire rope is used merely to raise and lower, and is relieved of all weight by the suspension or "catch" when the lamp is in position.

Martyn's Patent Cable Connector.

MESSRS. S. W. MARTYN & Co., of 11, Pratt St., Camden Town, N.W., have recently introduced a most effective mechanical cable connector, which is also simple and cheap.

The device consists of two hollow plugs, which screw into a specially shaped coupling. The ends of the cables to be coupled are bared in the ordinary way; the strands are then pushed through the plugs, and in each case bent back over the inner extremities of the plugs, and cut level, as shown in fig. 5A. The plugs are then screwed in, jamming the cable strands against the conical faces provided inside the coupling. For electrical work this joint can be insulated in the ordinary way, as shown in fig. 5.

FIG. 5.

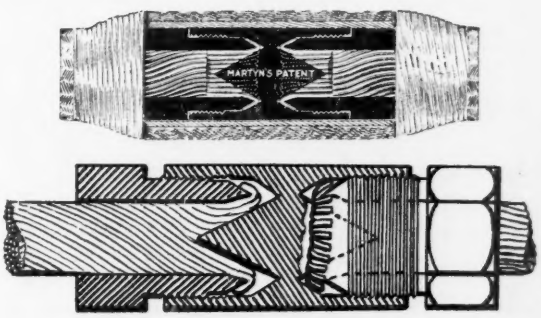


FIG. 5A.

The joint is claimed to be absolutely secure, both electrically and mechanically, owing to the cone formation of the surfaces holding the wires and the combined locking action of the screwed end pieces or plugs at the cone faces and at their shoulder ends. The contact surface is obviously large, and it is claimed that the conductivity of the joint is much higher than usual. The connector will be specially useful in temporary work or for power purposes, &c., and its low cost and ease of application also render it available for permanent work.

At present it is made with cable holes from $\frac{1}{16}$ to $\frac{1}{4}$ in. diameter, but larger sizes with three and four-way connectors will shortly be placed on the market.

Kuhl's Oil Filter.

THE accompanying drawing (fig. 6) shows a sectional elevation of Kuhl's patent waste-oil filter, which is being supplied by MESSRS. KUHL AND VOGT, of 5, Chester Road, Tuebrook, Liverpool.

Among the advantageous features claimed for this filter are the following:—The pads are of white clean cotton waste, which is cheap and easily obtainable. The two main pads are arranged so

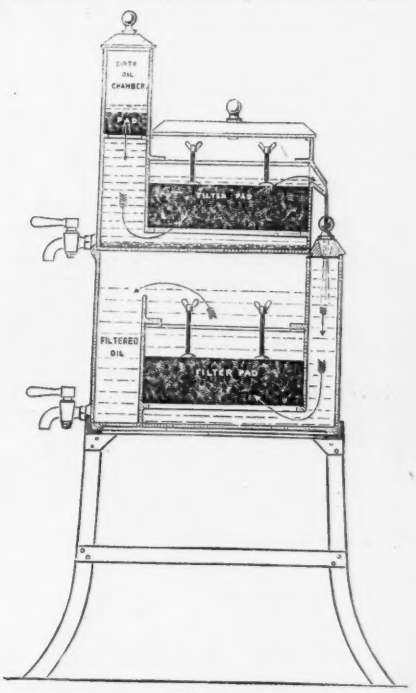


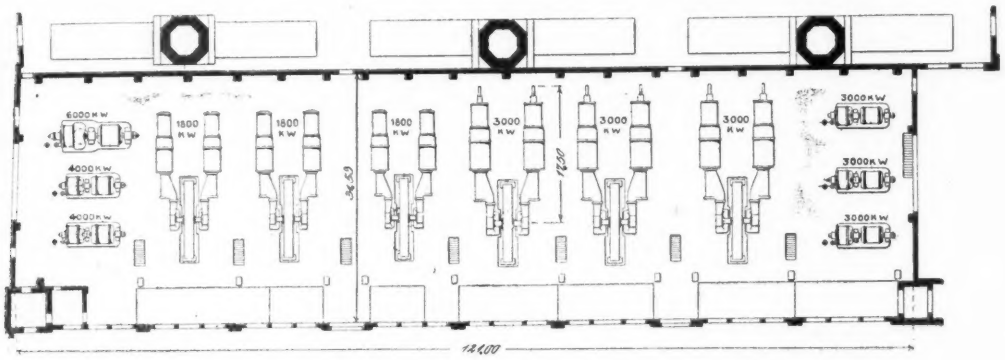
FIG. 6.

that all waste matter, such as water, sand, &c., falls to the bottom in the first chamber, the oil working its way upwards through the cotton, and falling down the spout into the second chamber. It then works upwards again and falls over the bridge which adjoins the pad in the clean oil chamber. The pads are easily taken out and replaced by new ones by loosening the thumb screw so that the bridges fall out of place. The life of the pads depends upon

the oil filtered. For dealing with very thick oil or fat, a steam or hot water coil is put in the back of the top chamber for liquefying purposes. The body of the filter is of cast-iron, and the stands are of wrought angle-iron, making a substantial apparatus. We understand that during the last four years many of these filters have been sold in England and the Colonies. Messrs. Kuhl & Vogt list them in sizes from 2 pints to 5½ gallons capacity, of heights from 12 to 50 in., but larger sizes are also made.

STEAM TURBINES AT THE BERLIN ELECTRICITY WORKS.

The large Moabit power station in Berlin was originally designed for a total output of 38,000 H.P., but owing to the introduction of large steam turbine sets, it has been found possible to arrange for 51,000 H.P. A ground plan of the station is shown below. There were at first three 3,000-KW. horizontal triple-expansion engines with sub-divided low-pressure cylinders, and four similar 1,800 KW. ones, but one of the latter has just been removed, and is to be replaced by a 6,000 KW. and two 4,000 KW. turbine sets, as shown on the left. A fourth 3,000-KW. horizontal engine was to be put down on the right, but in place of this three 3,000-KW. A.E.G. turbine sets have been installed. The central (reciprocating engine) part of the station covers a floor space of 30,000 sq. ft., or 2·08 sq. ft. per KW. The two turbine wings, on the other hand, only occupy ·45 sq. ft. per KW. This enormous saving in space is accompanied by increased simplicity and absence of auxiliary gearing on the part of the turbines. A complete set of consumption tests was carried out on the first 3,000-KW. turbine set at the end of 1906, and showed the extremely low consumption of 12·8 lb. of steam per KW.-hour, exclusive of condensation energy, but including excitation. The steam pressure was 173 lb. per sq. in., its temperature 309° C. The speed of the set was 1,500 R.P.M. The surface condenser required a 50-fold weight of cooling water at 10° C, and absorbed 54 KW. This consumption works out at about 8·6 lb. of steam per I.H.P.-hour, a value not hitherto attained, and it is interesting to compare this with the official trial test on the 3,000-KW. reciprocating sets in the same station made in 1904. These machines were of the best modern construction, and showed a consumption of 9·1 lb. per I.H.P.-hour at 184 lb. per sq. in. steam pressure and a temperature of 300° C. This being an official trial figure, whilst the turbine result was obtained during the ordinary operation of the station, indicates that in actual practice the results would be even more in favour of the turbine set, especially as the superheat temperature is to be increased later (such an increase not being permissible in the case of the reciprocating engines).—*Zeitschrift für das gesamte Turbinenwesen.*



Plan of the Moabit Station of the Berlin Electricity Works.

DE LAVAL STEAM TURBINES.

Writing to the *Electrical World* on the operation of De Laval steam turbines, Mr. F. J. Foote says:—

From the experience we have had, the one and only direct cause of the breaking of blades seems to be that of water in the steam. Our turbines are provided with a steam separator of ample capacity and the live steam chests of turbines are fitted with drain pipes leading to high pressure steam traps. Our most serious trouble with breaking of buckets was traced directly to the failure of these traps to operate properly. After putting the traps in order no further trouble was experienced with broken blades. That water should break out the blades is not surprising; indeed, when one considers that a slug of water strikes the blades with a probable velocity of 4,000 ft. per second, it is remarkable that the blades are not broken in large quantities. It is a well-known fact that a bullet striking a body of water will be flattened, and conversely one may expect that water having the speed of a bullet will have a powerful effect on any body with which it comes in contact.

One way of detecting broken blades is by the abnormal vibration of the flexible turbine shaft, the missing blades throwing the wheel out of balance. As soon as this effect is noticed the machine is taken out of service and examined carefully by dropping a miniature incandescent lamp down one of the nozzles, the valve and cap having been taken off, and turning the wheel very slowly by hand. In this way all the blades may be seen, one at a time, as they pass the point of the nozzle. A small hand hole in the wheel case cover would be a great improvement for this purpose.

As the machines are at present constructed, considerable labour is involved in replacing broken blades. The actual replacing of the blades is the work of only a few minutes to each blade, but before this work can be started the wheel must be slid out endwise several inches beyond the edge of wheel case. As the wheel shaft is solid and continuous with the pinion between the main gears, this means that almost the entire turbine must be dismantled. The manufacturers of this turbine could make a very great improvement, and one that would be very much appreciated by the operating men, by having a detachable coupling that would permit of getting at the wheel without removing so many parts.

Any good machinist can replace the blades. All that is required is to drive out the broken blades with a suitable punch and drive in the new ones, then file off the surplus metal to correspond with the blades in the wheel. We have never had a blade come loose in its socket; they break anywhere from the shank where they enter the socket to the head or tip. As to the number of breakages, we have had two machines in operation 120 hours per week for nine months and have broken less than 8 per cent. of the total number of blades in the wheels. These were broken for the most part during the initial period of operation.

Considerable trouble was experienced at the beginning with heating of the high-speed bearings. This, however, was undoubtedly due to dirt and foreign matter in the oil, or in the pipes when first put up.

Very careful attention should be given to the thorough cleaning of all oil pipes in the oiling system, and to the straining of the oil used. After getting the automatic oiling system in operation, in which all oil is filtered and double-strained each time it is used, little trouble has been had with hot bearings. Some uneasiness was at first felt by the high temperature at which the two bearings on either side of the gear case operated. On a warm day the temperature would sometimes reach 250° F. However, as there was no tendency to cut or draw the babbitt, this was taken as a matter of course. A small continuous stream of oil is kept flowing over the two bearings on each side of gear case and on the bearing at the wheel end of the shaft. The two bearings, which are really only stuffing boxes on either side of wheel case, are supplied by small sight-feed oil cups, feeding from two to four drops per minute. A certain percentage of this oil is lost in the exhaust steam due to volatilisation and the balance is collected and saved by means of special pockets at the sides of the wheel case. The steam used is condensed and a considerable quantity of it used again in the boilers without any inconvenience.

In regard to the parallel operation of alternators connected to these turbines, we have three-phase 60-cycle alternators, and the machines run together perfectly with practically no cross current. The load on each machine can be varied at will by changing the number of nozzles or by adjusting the governor while running. The only condition under which any hunting occurs is when there are considerably more nozzles open than required for the load carried. On closing these surplus nozzles the hunting stops at once.

As to steam economy, in order to get the best results it is necessary to keep the steam chest pressure as high as possible. This means that the number of nozzles open must be as small as possible and still maintain the required speed. It is best to have a steam gauge on both the steam main and on the steam chest below the governor valve. With more nozzles open than required, the steam chest pressure will be far below that of the pressure above the governor valve, with consequent loss of economy. On the other hand, too few nozzles open will cause the turbine to drop in speed. The exact number of nozzles to keep open depends on the kind of load and kind of service required. A careful operator will soon learn to detect speed variations by sound, and his judgment will indicate how many nozzles it is safe to keep closed at any given time. The builders have recently put quick-opening valves on their nozzles, which greatly facilitates the proper operation of these turbines.

AN AUSTRALIAN ELECTRICAL SCHEME.

[By Our Sydney Correspondent.]

The Queensland Government have recently had a report prepared with reference to the availability of the Barron Falls for an electric power scheme. The Barron Falls are situated about 20 miles from Cairns, close to the railway line from Cairns to Mareeba and Chillagoe. The report is based on a flow of 50 cb. ft. per second without storage, and 150 ft. per second with storage, the actual observed minimum being 41 cb. ft. per second. The total height of water in head race is taken at 956 ft., which with a flood level of 110 ft. above low water, and allowing for placing the station 15 ft. above this flood level, gives a total available head of 831 ft., and of this amount 13 ft. is again deducted for friction. 50 cb. ft. per second, with a head of 818 ft., is estimated to give 3,480 e.h.p., and it is recommended that under this scheme, 4 units of 1,160 h.p. each should be installed, leaving one as a spare. It is proposed to generate at 6,600 volts, and transform up to 30,000 volts for long distance transmission, using overhead mains with steel poles. The penstock is to be concrete, with a pipe line of rivetted steel coated with asphaltum. This tunnel would be 5 ft. 6 in. diameter and 3,886 ft. in length, with a total fall of 6 ft.

Two estimates are given, No. 1 for utilising 50 cb. ft. per second, and No. 2 for utilising 150 cb. ft. per second.

Estimate No. 1.

	Capital cost.	Annual maintenance.
Dam, headworks and outlet works	£2,590	£100
Tunnel	17,700	
Preliminary plant for construction	2,500	—
Clearing and excavating for tramway and pipes	1,800	100
Tramway, and machinery connected therewith	2,100	
Pipes, and laying same...	5,550	166
Power house	2,000	30
Generating plant (turbines, alternators, exciters and switchboards)	19,000	570
Poles, insulators, and erection of line to Cairns	9,450	283
Copper in line	8,220	123
	£70,910	—
Preliminary expenses, compensation, &c. ...	1,000	—
Loan flotation, interest during construction, printing, advertising, &c.	2,750	—
Engineering expenses, fees, cost of survey, clerk of works, &c., say, 8 per cent. on £70,000	5,600	—
	£80,260	£1,372

Annual Cost.

Interest, 3½ per cent. ... Sinking fund, ½ per cent. Reserve fund, 2 per cent. } = 6 per cent. on £80,000	... £4,800
Maintenance as above	... 1,372
Salaries and wages	... 3,654
Stores	... 250
	£10,076

Uses.

It is estimated that use will be made of the power in the following directions:—(1) The lighting of the town of Cairns and the cost of a transformer sub-station and mains reticulation is estimated at £5,000. It is proposed to charge 9d. per unit for lighting for private consumers, 3d. per unit for street lighting, and 2d. per unit for power and the consequent receipts and expenditure are estimated as follows:—

Receipts.		Expenditure.	
Lighting, 100,000 units at 9d.	£3,750	Interest and sinking fund on mains, 10 per cent. on 5,000	£500
Streets, 18,000 units at 3d.	225	Wages and salaries ...	1,400
Power, 30,000 units at 2d.	250	Stores	200
		Electrical energy purchased	2,000
		Balance to credit ...	125
	£4,225		£4,225

Estimate No. 2.—*For utilising* 150 *cb. ft. per second to develop* 10,500 h.p.

Additional cost.	Capital.	Maintenance.
Pipes	£5,500	£166
Power house erection	1,000	15
Plant	17,500	525
Copper in line of transformation	10,000	300
Storage	10,000	200
	£44,050	£1,206
Engineering expenses, &c., 10 per cent. on £44,000	4,400	—
No. 1 estimate as above	80,260	1,372
	£128,710	£2,578

Annual Cost.

Interest, sinking fund, reserve 6 per cent. on £129,000	£7,740	£7,740
Maintenance as above	—	2,578
Salaries and wages	—	4,446
Stores...	—	400
		£15,164

2. Electrically-operating railway. On the basis of one train starting on a heavy grade and two trains running, it is estimated that the maximum horse-power required will be 1,200, with an average of 400. The trains are reckoned at 110 tons and are to attain a speed of 20 miles per hour up a 2 per cent. grade, accelerating from rest to full speed in one minute. The weight of loco. required is estimated at 30 tons, and a 40-ton loco. is advised for use.

3. Electrical operation of sugar mills; (4) manufacture of calcium carbide.

The final estimates of revenue are as follows:—

	h.p. required.	Annual revenue.	Revenue per h.p. per annum.
Cairns lighting ...	200	£2,000	£10 0 0
Railway average ...	400	1,100	2 10 0
Sugar mills	400	1,200	3 0 0
Calcium carbide ...	2,400	8,400	3 10 0
	3,400	£12,600	

The estimates of revenue appear to be somewhat rose-coloured, in view of the fact that Cairns is only a very small town with a large proportion of Chinese, Japanese, &c., and is situated well within the tropics, and does not appear to have any reasonable likelihood of becoming a manufacturing centre. It would be a very long time before the annual consumption of current for lighting purposes would reach anything like 100,000 units. On the other hand, £5,000 for a sub-station and mains for the town, added to a cost of £17,600 for the line from the power station to the town, sounds to anyone who has ever been in Cairns, positively ridiculous. Again, £1,400 for wages and salaries seems rather high. One could supply and erect a plant sufficient for Cairns' wants for many years to come, including all mains, for about £2,500, and run it for a total annual cost little, if any, more than the amount estimated for wages. The railway does not seem an ideal proposition either for electrification, consisting as it does of a main line with a very very small number of trains per day, no local traffic and very heavy grades, and numerous small radius curves. It is very unlikely that any of the sugar mills at present in the district would go to the cost of converting to electric motors, and it must also be remembered that a certain amount of steam, and no small amount, is required in the process of manufacture; moreover, a large portion of the fuel burnt consists of the megasse, or refuse from the cane after crushing. The manufacture of calcium carbide also seems somewhat visionary in view of the fact that the necessary materials are not to be found within such a distance as would make the cost of transport a negligible quantity. On the whole, therefore, it does not appear to be a proposition which would appeal favourably to an investor, however it may look to a Government, as it would be a very long time before the estimated revenue was reached.

LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names may be made. Answers are furnished by a barrister-at-law.*]

No. 89.—*Prepayment Meter—Faulty Register—Liability of Consumer.*

"Quay" writes:—"A prepayment meter is fitted in a consumer's premises. Cash is taken from the meter at regular periods of about three or four weeks, and the amount so collected was some pounds during six months.

"Six months after the end of the first period of six months, an account is rendered to the consumer for the total amount of light registered by the meter. He is credited with the amount of cash taken out during the same period. There is a deficiency which is the amount of demand note, and is treated as still owing by consumer.

"Is the deficiency a legal debt; is inaccuracy of meter, the supplier's responsibility; and can the same be recovered by them?

"I must add that the meter was changed in the first month of the second period, and was deemed by suppliers to be 'out of proper order.'"

*** Unless it is made quite clear by the consumer's agreement that the amount which he prepays is only to be "on account" of the proper charge for gas or electricity consumed, it would seem to be impossible to say that he must pay more than he has already paid. If the meter is wrong, that is a matter for which the undertakers are responsible. It may be mentioned, as a matter of interest, that it was decided in the case of Edmundson *v.* Longton Corporation (1902), 19 T.L.R. 15, that in the case of coins being stolen from a prepayment meter, without any negligence on the part of the consumer, the undertakers must bear the loss.

A NEW CONCRETE POLE.

The great progress made in long-distance electrical transmission in recent years has brought the question of poles for the overhead line into great prominence. Wooden poles are cheapest in first cost, but their life, even when impregnated, is not long. Iron poles, both tubular and of lattice work, are much more effective, but are expensive both in first cost and in upkeep (painting, &c.). Several attempts have also been made to employ concrete either as a protective socket or for the material of the pole itself.

Poles made of reinforced concrete, however, have hitherto been heavy and have been otherwise unsatisfactory, either on account of their sectional construction or because the wooden core on which they are usually formed is liable to expand and so cause the destruction of the pole.

The well-known Lucerne architect, H. Siegwart, has, however, recently patented a mechanical method of making hollow cement poles of any length and with any desired taper, which would seem to offer a satisfactory solution. We take the following particulars of the process from the *Zeitschrift*

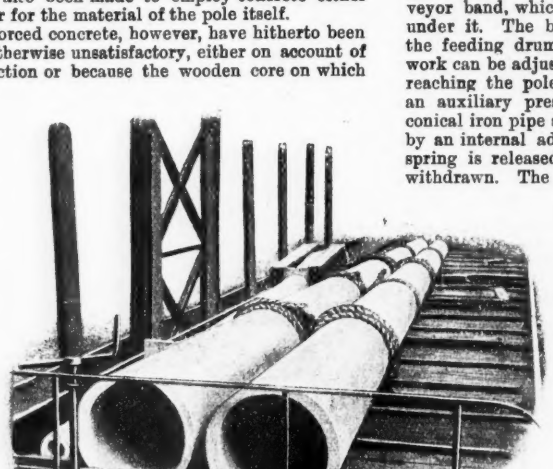


Fig. 2.

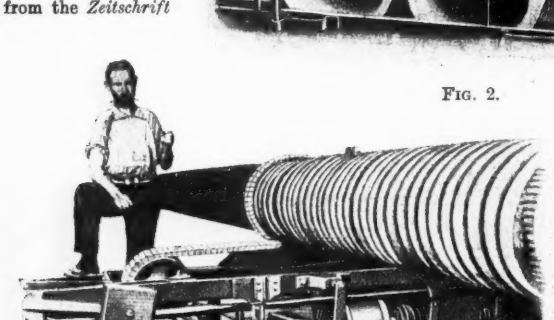


Fig. 1.

für Elektrotechnik und Maschinenbau:—The poles are circular in section, and have a wall thickness varying from 1 in. to 2 in. They are constructed on the same lines as reinforced concrete, the inner case being made up length-wise of a series of wrought-iron or steel rods of circular section, held

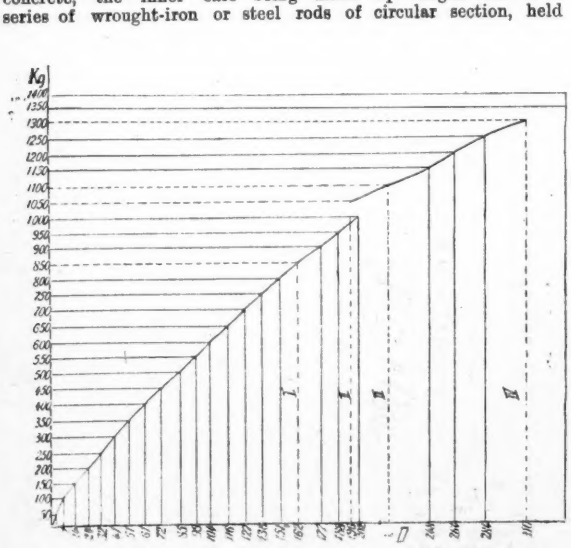


Fig. 3.

together, and at fixed distances from one another, partly by interwoven iron distance pieces, and partly by a continuous outer spiral winding. To this base the actual material of the pole is attached under pressure. This material consists of coarse sand mixed in a definite experimentally determined proportion with Portland cement and water. This cement is wound over the iron frame by means of an endless band conveyor, as it can be best dealt with mechanically in this way. Part of the machine used is shown in fig. 1. It consists essentially of the filling and distributing apparatus, the applying apparatus with pressure arrangement, a second equalising pressure gear and the adjustable mandrel on which the pole is built up, and which is driven by two lathe-heads. The filling and distributing apparatus receives the concrete material, and delivers it through a rifled drum on to an endless woven conveyor band, which applies the concrete to the frame as it passes under it. The band then passes over a jockey pulley and back to the feeding drum. The pressure of the band against the framework can be adjusted up to 1 ton or more. The material after reaching the pole is subjected to additional pressure by means of an auxiliary pressure drum. The long mandrel consists of a conical iron pipe slit lengthwise, and kept at any desired diameter by an internal adjustable spring. After a pole is completed this spring is released, and the mandrel contracts and can easily be withdrawn. The iron framework is mounted on the mandrel with air clearance between the two. One of the two lathe-heads by which the mandrel is driven is fixed at the starting point of the pole, whilst the other can be fixed at any desired distance away from the first. The endless band is fed forward (so as to lay the concrete on spirally) by means of chain and worm gear driven from the lathe heads. The whole machine is worked by an electric motor situated beneath the base. The succeeding spirals of cement are welded together during the operation by giving the band of concrete a wedge-shaped edge. The whole is further consolidated by a spiral of wire wound on over the concrete. A temporary covering of woven material is also wound over the concrete, but is removed after the poles have hardened. This covering also serves to keep the cement moist for the necessary length of time. Two of the finished masts are shown in fig. 2.

The results of a test on one of these poles are shown in fig. 3. The pole was 7·25 metres long overall, and was cast into two massive concrete blocks at one end, leaving a free length of 6 metres. A gradually increasing drag was applied at the free end, in a horizontal direction, as shown in fig. 4, where D is a dynamometer and F the pulley block for applying the drag. The outer diameter of the pole was 430 mm. at one end and 270 mm. at the other.

The thickness of wall was 30 mm., and the internal core was made up of 33 wrought-iron rods 7 mm. in diameter each (12·2 sq. cm. total section).

The test showed that at point I (fig. 3) cracks appeared at the pressure zone; at II the pole showed a permanent deflection of 60 mm., whilst at IV the pole broke with a drag of 1,300 kg.

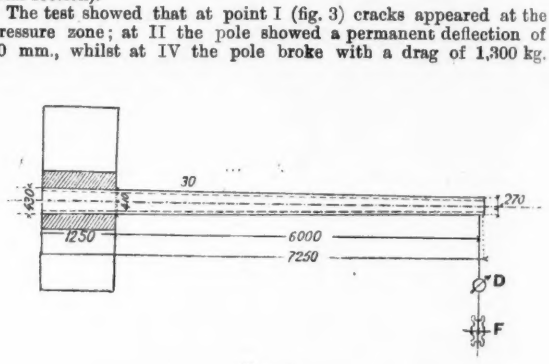


Fig. 4.

through the bulging of the iron rods. Allowing a compressive stress for concrete of 30 kg. per sq. cm. (430 lb. per sq. in.) and a tensile stress for iron of 1,200 kg. per sq. cm. (17,200 lb. per sq. in.), the safe load for this pole should be 236 kg., which gives a factor of safety of 5·5 by the test.

Calcium Carbide Works in Ireland.—There are a number of water powers in Ireland which might be used for the production of power for electro-chemical or electro-thermal operations. Several of these are being utilised for the production of calcium carbide. In connection with one of these schemes, an order has recently been placed by Mr. Frank Broadbent, M.I.E.E., consulting engineer, for a 640-H.P. Gilkes turbine coupled to a 430-KW. single-phase Mather & Platt alternator. This forms the second set of this size for the works in question, and the turbine will operate on a 34-foot total fall and develop the power at 300 R.P.M. Owing to the possibility of getting the furnaces close up to the water power, the alternators are run at low voltage—viz., 50 volts, and are capable of developing up to 10,000 amperes. They are self-regulating for constant output, and the turbines therefore are not hydraulically governed. As might be supposed, special attention has to be given to the conductors carrying currents of the magnitude of 10,000 amperes.

PARLIAMENTARY.

Radio-Telegraphic Convention Committee.

Sir J. Dickson Poynder (chairman) presided over a further sitting of the Committee on Tuesday last week.

Commander Payne, recalled, said that he was at present the chief technical adviser to the Admiralty on all points connected with wireless telegraphy, and had studied the matter constantly since 1900. He was responsible for the design of all wireless telegraphy instruments used in the service, and also for the organisation of the wireless telegraph signalling and the details of the training of the officers and men engaged in the service. At one time, before the Convention, he held the opinion that the organisation already established by the Marconi Co. would be of great benefit to Great Britain if it could be extended, and that if the Convention took away the monopoly of Great Britain it would be detrimental to the country. Since the Convention had been drawn up, his views had been considerably modified, for it was apparent to him that had Great Britain stood out other nations would have joined together, and the idea of a British monopoly all over the world would have been out of the question. The rules and regulations had been framed in such a manner as to remove the feeling he formerly had that Great Britain might be giving away the position she had by being first in the field. Great Britain would derive considerable benefit by such an agreement, because it would overcome the objections which would have arisen if she were a monopolist, and the Convention would tend to increase the development of science for the benefit of the public all over the world, which would not have been the case under a British monopoly. Had not Great Britain had a voice in the framing of these regulations, then probably other rules and regulations would have been brought forward which would have been to her distinct disadvantage. Now the various Governments would control the various companies working in their countries, and communication would be made possible. He considered communication between various systems of vital importance; there were not any technical difficulties in the way which could not be overcome, for communication in time of war was of the utmost importance. Providing that the ships in the mercantile marine were fitted with apparatus capable of communicating with the Naval ships, and that the methods of signalling were known, there would be no difficulty in arranging for intercommunication, and the relative advantage which Great Britain would derive from this intercommunication, as compared with the benefits to other nationalities, was in the proportion of British ships fitted with wireless telegraph apparatus, and as this country had the largest mercantile marine she would be in the best position. He felt that under a system of British monopoly they would have lost the benefits of the work of foreign scientists.

Capt. Bethell, replying to the Chairman, said that he had had practically the whole of the wireless telegraph service of the Admiralty under his control. He was one of the delegates at the Berlin Conference. He agreed with the evidence that had been given by his colleague, Col. Daniell. He had read Mr. Cuthbert Hall's evidence, particularly that portion in which he alleged that the Admiralty had made a violent change in their policy in regard to intercommunication. When he first joined the Admiralty in 1903, the question of the attitude of the delegates to the 1903 Conference was brought up, and he was asked to advise Lord Selborne with regard to the policy that the Admiralty should pursue at that Conference. The advice he then gave was that, first, he thought there was no possible power in the hands of the British Government to enforce anything that was decided at the Conference with regard to intercommunication; and, secondly, the state of the naval instruments at that time was of such a rough and ready sort—they had no system of tuning, they had only a few ships equipped, and the results they got were very uncertain—that he did not consider the time was then ripe for anything of the kind, and that, therefore, the attitude of their delegates should be one of reserve. That was more or less the view that was taken by the Admiralty until the question cropped up again with regard to a future Conference. Up to that time he had considered the question a good deal, and had made up his own mind that general intercommunication was not a good thing. He was dead against it, and so he was at the present moment—by that he meant general compulsory intercommunication, with no exceptions at all. He advised that they should stick more or less to their previous policy, only that they should go wholly for rejecting general intercommunication. In 1904 he drew up certain conditions which he thought we might accept, on the understanding that in the opinion of the Admiralty sufficient regulations could be drawn up, together with provisions for their enforcement. He thought then there would be no objections to the Admiralty agreeing to general intercommunication. Eventually it was agreed that the policy of general intercommunication should be accepted, but that we should insist upon being able to exempt any stations that we liked. He placed great stress upon that exemption clause, because he had a certain amount of sympathy with the Marconi Company, and he thought that they had done a great deal for wireless telegraphy—they had built up an organisation which undoubtedly in time of emergency would be of great benefit to the Admiralty, and he did not wish to do anything which would in any way jeopardise that organisation, even if only for a short time. His objections to general intercommunication were not that he thought it impracticable in any way—physically he saw no difficulty in the matter whatever. He believed that very exaggerated language had been used as to the disorganisation and interference that was going to happen. He did not believe that any difficulty whatever would arise.

With the power of exemption you withdraw your objection to intercommunication?—Decidedly.

Replying to Mr. S. Buxton, Witness said that he was thoroughly satisfied now that the Convention would work to the advantage of the Admiralty.

By Sir E. Sassoon: The spark system and the continuous-movement system could, in his opinion, easily be made interchangeable.

Replying to Mr. Adkin, Capt. Bethell said that England would be at a great disadvantage if she refused to ratify the Convention.

Mr. Babington Smith, secretary to the Post Office, recalled, read a letter he had received from M. Bordelongue, the principal French delegate at the Berlin Conference, traversing certain portions of the evidence of Mr. Cuthbert Hall. Mr. Babington Smith said it had been stated before the Committee that there was no company carrying on a commercial business in wireless telegraphy, with the exception of the Marconi Co. He had made inquiries as to the traffic transmitted by the de Forest stations on the coast of the United States, and had received information that during the six months ended April 30th, 1907, they transmitted from ship to shore 46,182 messages, and from shore to ship 32,887—a total of 79,069, which, if it had gone on for a year in the same proportions, would mean a little over 158,000 messages in the 12 months. The total number of messages received and transmitted by the Marconi shore stations in the United Kingdom, leaving out of account Poldhu, were 16,035, so that the business transmitted by the American de Forest stations was very much larger than the business transmitted by the Marconi stations of Great Britain. The figures he had given in neither case were official, but he had no doubt of their accuracy. They had been officially informed by the Netherlands Government that 2,700 messages were received and transmitted from the Dutch station at Scheveningen in 1906, a larger number than the number sent and received over the Post Office wires by any of the Marconi stations in this country, excepting Browhead and the Lizard.

Witness also referred to the evidence which had been given by various witnesses, who said that they thought the ratification of the Convention would retard the progress of scientific invention in wireless telegraphy, and said that he was of opinion that so far from that being the case, the Convention would tend to promote progress. He further said that he thought the restrictions as to wave lengths in the Convention had been misunderstood—great latitude was allowed in that respect to suit particular circumstances.

The Committee then adjourned.

Electricity in Workhouses.—In the Parliamentary Papers for May 16th, Sir William Bull asked the President of the Local Government Board as to the issue of a code of suggestions and instructions to Boards of Guardians as to the mode of constructing workhouses and infirmaries, and whether any suggestions had been issued for the guidance of guardians as to the best mode of equipping these institutions with electricity for lighting and power purposes. Mr. J. Burns replied that a memorandum on the construction of poor law infirmaries had been issued, but no suggestions were made as to the provision of electricity.

Folkestone, Sandgate and Hythe Tramways Bill.—In the House of Commons on May 16th this Bill was read a third time.

North-East London Railway.—In the House of Lords on May 16th this Bill was read a third time and passed.

THE CONTINENTAL ELECTRICAL ENGINEERING INDUSTRY.

An Improvement in the Financial Results.

(*Concluded from page* 824.)

The Voigt & Haeffner Co., of Frankfort-on-Main, which has a share capital of £100,000, proposes to increase it to £150,000 this year. According to the report of the directors for 1906, the turnover advanced by 45 per cent., the augmentation being mainly in the inland market and this necessitated extensions of the works. The rise in the prices of raw materials was a matter of some concern, especially in the case of metals. The accounts show net profits amounting to £27,728, as contrasted with £14,113 in 1905, and a dividend at the rate of 10 per cent. has been declared, as against 7 per cent. in 1905. At the end of last year the company employed about 1,000 officials and workpeople. A large amount of business was brought over into the current year, and a further increase in sales has taken place in the first few months as compared with the equivalent period of 1906.

The Deutsch-Niederlandische Telegraphen Gesellschaft (German-Netherlands Telegraph Co.), of Cologne, which has a paid-up share capital of £350,000 and a loan debt of £362,500, has now terminated its first complete working year. As will be remembered, the company enjoys a joint subsidy from the German and Dutch Governments, totalling £95,000 per annum, for its cables in the Far East, whilst 10 per cent. of the cable receipts are received by the company. The gross revenue earned in 1906 reached £101,020, or £6,020 in excess of the subvention, and the net profits, including the balance forward, amounted to £34,103. It is intended to pay a dividend at the rate of 6 per cent., to place £1,705 to the reserve fund, £1,500 towards the establishment of a pension fund, and £1,500 towards the

eventual provision of duplex apparatus. The cable system was opened throughout its whole length on November 1st, 1905, and the undertaking has since then developed in a satisfactory manner, and in accordance with the original calculations. The cables have been free from any serious interruptions, damages having only been caused on two occasions by ship anchors at the mouth of the Yangtse River, and these were quickly repaired by the Great Northern Telegraph Co. The company has completed large tanks and tank hall at Woosung, near Shanghai, for the storage of stock cable.

The following announcements refer to other German companies for 1906, the figures given in parentheses being the results for the preceding year:—Duisburg Cable Works, 10 per cent. (8); Wilhelminenhof Cable Works, 15 per cent. (10); Electro-technical Works of Max Schorch & Co., 8 per cent. (8); United Insulator Works, 12 per cent. (12); and the Dr. Paul Meyer Co., 6½ per cent. (6½).

Swiss and other Works.

The Aluminium Industry Co., of Neuhausen, which has just declared the highest dividend paid in the history of the undertaking, was fully occupied during the whole of 1906 at the works at Neuhausen, Rheinfelden and Lend. The report passed at the recent meeting stated that the demand for the company's manufactures was very brisk, and as an immediate advance in the production was impossible, an increase was made in the prices. All the aluminium producing works in the world had endeavoured to extend their old plant and establish new works, and the greater output would partly appear on the market in the second half of 1907. The quantity available in 1908, according to the report, would be so large that the price of the metal would decline. The company has increased its share capital from £640,000 to £1,040,000, although only one-half of the total is paid up. The accounts are briefly as follows:—

	1906.	1905.
Share capital (paid up) ...	£520,000	£520,000
Loan capital	227,000	229,000
Net profits	313,600	185,000
Depreciation provision ...	103,760	88,400
Dividend, per cent. ...	26	22

The report refers to the progress made in connection with the utilisation of water power in the Vallais canton, although the date of the completion of the works is not mentioned. The contract for the construction of the tunnel for the Rhone Works will be placed shortly, and the new installations at Goldschmieden and Marseilles will be started at the end of 1907. Bauxite mines have been secured in the South of France, and these will assure the company of supplies of the material for many years. The accounts for 1906 show for the first time an appropriation, amounting to £20,000, for the establishment of a pension and assistance fund.

The Alioth Electricity Co., of Basle, which has a preference share capital of £120,000, and ordinary shares amounting to £120,000, delivered dynamos and motors of a total of 95,696 H.P. in 1906, as compared with 51,081 H.P. in 1905, and transformers of 59,670 H.P. and 23,367 H.P. respectively. The directors state that satisfactory results were obtained with very high pressures for the transmission of power and also in regard to electric traction. As to the working of main lines of railway, the experiments were continued with favourable results, and a locomotive of 2,000 H.P. was now being built on a new system for abroad. The accounts indicate gross profits of £32,040 for 1906, as against £23,200 in the preceding year, but the net surplus has only allowed of the payment of 5 per cent. on the preference shares, as in 1905, the ordinary shares again not receiving any dividend.

The accounts of the Compagnie Francaise Thomson-Houston for 1906, which were approved at the recent annual meeting, exhibited gross profits amounting to £168,000, as compared with £170,000 in 1905, and the sum of £86,800 out of the former was derived from manufacturing operations, as against £80,000 in the preceding year, the balance in each case being the yield from investments. The net profits were £97,600, as contrasted with £90,400 in 1905, the improvement being due to the repayment of bonds and non-necessity for interest payment on those redeemed. It was decided to pay a dividend of £1 2s. per £20 share, as compared with £1 in 1905. The increase in orders has rendered it essential to extend the works at Neuilly-sur-Marne, and a site has been secured at Lesquin, in the Nord, in order to cope with the development of the trade in turbines on the Curtis system.

The works of the Felten & Guilleaume Co., of Vienna, according to the directors' report for 1906, were fully employed during the year, and the inland industry for the first time for years participated in the business prosperity of the world. The apprehensions that the high prices of metals would affect the consumption in the electrical trades had not been realised. As to the increased cost of copper, the improvements made in the manufacture of cables had almost equalised matters in so far as normal sections were concerned. No danger was to be feared from that quarter, and a decline in the period of prosperity would only be apprehended in the event of the general industrial activity experiencing a serious set back. The accounts show net profits of 2,253,087 crowns, as compared with 1,467,729 crowns in 1905, and a dividend has been declared at the rate of 15 per cent., as againt 12 per cent. in 1905.

The A. E. G. Thomson-Houston Co., of Milan, has now been in existence for three years. In the course of the report for 1906 it is mentioned that in consequence of the favourable industrial situation the company was the recipient of an abundance of orders for extensions of lighting and power stations and the equipment of new works, and also for tramways and railways. Notwithstanding the large demand, the abnormal condition of the market for electrical manufactures continued, and prices consequently remained low. The net profits amounted to £11,800, as contrasted with £4,380 in the previous year, and a dividend of 5 per cent. has been declared on the share capital of £204,000, as compared with 2 per cent. in 1905. The organisation of the company has fully corresponded to expectations, and the branches opened at Bologna and Leghorn at the beginning of 1906 have developed in a satisfactory manner.

APPLICATIONS.

By APPLIQUE.

It would not be any exaggeration to say that 98 per cent. of central station and mains engineers, from switchboard attendants to chief assistants, in this country, on receiving their weekly copy of the Electrical Review, or whatever technical journal they take, open it at the "Situations Vacant" columns, and scan them more or less eagerly, to ascertain if there are any vacancies in them to suit their particular fancy.

Occasionally some member of the fraternity goes to the trouble of writing a letter to the papers, proving beyond a doubt (to his own satisfaction) that 99 per cent. of the positions advertised are already given before the advertisement appears, but, in spite of this obvious fact, scores of applications are received from every part of the country for every position advertised, whether it be switchboard attendant, at £1 per week of 56 hours, or chief engineer of one of the big cities, at £1,000 a year. Presumably, each of these applicants has more or less faith that the particular post he elects to put in for is the odd one in the hundred, or he would scarcely take the time and trouble to make out an application for it.

Having found a suitable vacancy, the next move is making out an application for it, which, when properly done, is a very much more difficult matter than it appears to be. It is a remarkable thing, considering what a wide and comprehensive education the majority of engineers receive, how comparatively few of them can write a really strong, lucid and attractive application, even when their qualifications are, proportionately to the berth desired, of the best.

Some men apparently consider any string of paragraphs stating the different positions they have held, and their length of service in each, no matter how crudely and slip-shod the whole thing be put together, to be sufficient to obtain for them the position they covet; in fact, there have been instances where applications have been received for responsible positions on a single sheet of notepaper, and others on leaves torn out of an exercise-book. Whether such an application was ever successful is more than doubtful. A slovenly-written, badly-worded, slack application is, in nine cases out of ten, a sure index of poor business capabilities in the writer, and one well written, well composed, and put together in a neat, clear and concise form, equally, of course, an index of the good business abilities of the compiler.

The practice now adopted by many municipalities and private companies of sending out a printed application form, with a number of questions on it to be answered by the applicant, has probably originated from this inability on the part of otherwise well-educated men to write an intelligent application. To some extent these forms overcome the difficulty for him, without handicapping his more fortunate and versatile brother who finds no difficulty in making out a good application, in that it is usual to state that a more amplified description may be sent in, if desired, with the printed form. The questions asked are usually such that the obvious replies to them, even when set down in the most cryptic form, give a very much more lucid description of a candidate's qualifications than the average application sent in by the majority of men without this form, even if no more detailed account be sent with it.

Applications may be classed briefly under three headings: (1) the Indifferent; (2) the Amateur; (3) the Ideal. To deal shortly with the first and last of these.

Under the title "Indifferent" come the applications sent in by young fellows who, to use their own expression,

"have a shot at everything going" for the sake of trying to make a move from their present position: in fact, applying for every berth that is advertised, indiscriminately. A little thought on their part would convince them that in a great many cases their qualifications and experience are not of a high enough order to give them a chance of being selected; and in others the position, if they did get chosen for it, would often be a retrograde movement to their future prospects. If a man wishes to change his position, it is usually a mistake to take up another berth that is not a step higher in some way; he should not be content to move to a similar position just for the sake of a change of environment. A testimonial from one station for two years' satisfactory service is of more value than two testimonials for twelve months each, for two similar berths, from two stations, as chief engineers and committees have a way of objecting to men who are continually chopping and changing.

With regard to the third class, "the Ideal application." They are the applications received from men who have had much experience of the game, who have put in for berth after berth, only to be disappointed time and again, and after each attempt have gone through their application, finding and strengthening the weak spots in it, so that it has gradually gone through a course of elimination and reconstruction, and has reached such a degree of perfection that it is almost impossible to improve on it. This last class of men will reap no benefit from this article, as it is written with the hope that it may help the second class, the "Amateur."

Now, the "Amateurs" belong to neither of the above classes, although they have characteristics of both, as their applications are a combination of the earnestness of the latter and the inexperience of the first. They are the applications received from men who do their best to make out a strong case, but fail for several reasons. The first and most apparent is inexperience, through not having had sufficient practice at revising their applications. They have not been through the valley of the shadow of hope doomed to disappointment, and had to turn back and dissect their efforts to get at the weak parts often enough. Secondly, they have little or no real idea of how to frame and build up an application, and it is more or less natural that they should not care to go to their colleagues for advice on the subject, so they have to blunder along until they eventually discover the truth.

The ideal application has four important characteristics: it must read freely and easily, it must be concise, short, and must be neatly written (or typed, as the case may be) and got up, and, of course, the qualifications must be good, according to the position it applies to.

With regard to the first essential—that it must read well. If a reader in going through an application finds it disjointed, cryptic, a number of statements put down anyhow, without any apparent relation to one another, a mass of bald facts, from which to derive any real estimate of the applicant's qualifications he must read through two or three times, he gets an unfavourable impression of the candidate before he begins to weigh it up at all; but, on the other

COUNTY BOROUGH OF L————

Electricity Department.

Appointment of Chief Electrical Engineer.

Application

of

Thomas John Thomas, Chief Assistant Electrical Engineer at the R———— Corporation Electricity Works.
Late Second Assistant Engineer at the G————, &c.

Fig. 1.

hand, if it reads freely and easily, each paragraph carrying him on naturally from one phase to another of the applicant's experience, and so making the whole read like a single paragraph, he doesn't need to go through it repeatedly to get at the text of it and instinctively feels that he is dealing with a good business man, and puts it on one side among the sheep for future consideration.

Secondly, it must be concise, every statement being set down clearly in plain simple language that definitely and distinctly describes the exact character and nature of the duties and responsibilities of each position the applicant has held, together with the general experience gained, and any experiences peculiar to his term of office, such as large extensions to the station plant, or mains, or tramways equipment, &c. The general experience should also describe the peculiarities of the station and system of distribution, as traction supply with battery and booster, five-wire system, separate arc lighting system, sub-stations, &c., but everything must be written in clear elementary English, without any attempt at high-sounding high-flown phrases scattered through it.

Thirdly, it must be short, not, of course, of a necessity short in the sense that it only covers one sheet of foolscap, as the actual amount of writing required for any application must necessarily depend on the extent of the applicant's

SUMMARY OF EXPERIENCE.

Mechanical Training.	Three years' apprenticeship at G———— Engineering Works, London. Two years Engineer-in-charge of outside constructional work for Messrs. F————, Engineers, Kilburn, London. &c.
Electrical Training.	Two years' apprenticeship at the T———— Corporation Electricity Works. —— years with Messrs. S————, Electrical Engineers, H————. One year Switchboard Attendant at the D———— Electricity Works. Two years Shift Engineer at the D———— Electricity Works. &c.
Technical Training.	Three years as a day student at ———————— College. —— years at ———————— Technical School as an evening student. &c.

Fig. 2.

experience and qualifications. The term shortness, as used here, means that every portion of the applicant's experience detailed in the application should be expressed as briefly as is consistent with a lucid description of that experience.

Fourthly, the actual construction of the final copy of the application. If it is to be written, it should be as neatly and clearly written as possible on plain white foolscap, with a broad margin on the left hand side (say about 1½ in.), and plenty of room left between each paragraph. It may be typed or printed; though this last is rather an expensive process. If it is typed, a very neat and easily read document is presented, which is very acceptable to anyone who has to wade through a few score of applications.

The following is a brief description of a very good general type of application; it was typed and made up on plain white foolscap. The first sheet was the title page, and was got up as in fig. 1; the second sheet was a summary of the whole of the applicant's experience, each part under a separate heading, as in fig. 2; then followed the details of his experience and qualifications, age, &c., and finally copies of recent testimonials and a list of references. The whole fastened together at the corner made a neat, clear and forcible application.

When an application is typed or printed, the letter submitting it to the advertiser should always be in the candidate's own handwriting, as employers generally like to see a specimen of a candidate's caligraphy.

In these days of strenuous competition, no man can afford to neglect any possible assistance, or leave any stone unturned to advance his candidature, and one of these efforts is, undoubtedly, the quality of his application. To the ambitious man the ability to write an application is eminently necessary, and a lack of this ability often stands between him and the attainment of his object, even when his professional qualifications are great; if, therefore, the attention of readers is drawn to this, the object of this article will have been accomplished.

REVIEWS.

The "Engineering" and Electric Traction Pocket-Book. By Philip Dawson, M.Inst.C.E. Fourth edition. London: *Engineering*. 1906. Price 20s. net.

The first edition of this valuable standard of reference for all who have to do with tramways was issued in 1899. It never was a pocket-book in more than the compiler's pretty fancy, but always went easily into a portmanteau.

The highest praise we can give the fourth edition, is to say that it has brought the work up to date without increasing its size in any particular. Much of the old matter has been discarded, certain new features have been incorporated, yet the weight and the number of pages remain the same.

Starting with the track, the simplest way to review the book is to compare the first and last editions by sections, and we may gather at the same time some idea of the advance in methods and appliances which has been made in the most important seven years in the history of street travel.

The American costs of construction are reproduced from the first edition, but the English costs are revised, and the difference is marked; the prices of material, the cost of labour, and the quantity of material all having risen. The total of the two estimates differs by £1,419 per mile of single track, of which, perhaps, a good deal is due to better paving.

Insignificant improvements have been made in copper bonds, but the Thermit weld has been introduced, and the Falk cast weld and the electrically-welded joint have been used more extensively than in 1899.

The British Standard specifications and dimensions are printed in the sections to which they apply.

The first edition necessarily was the result much more of American than of British experience, and the present edition still suffers in consequence. The American flavouring is too pronounced for anything but an American edition, and in the next it might be boiled out to a considerable degree, making the book more suitable to our wants.

The turbine section is one of the new things since 1899, and is representative of all the known forms, with which it deals copiously and well.

The boiler section still remains the longest (158 pages), although a good many of the data on riveting have been deleted. They are not missed. Galloway tubes still disfigure the illustration of a Lancashire boiler, but the Cahall boiler is no longer included. Tables, by Bryan Donkin, of efficiency and coal consumption of various types of boiler have been added.

The stunted growth of the refuse destructor portion is unexpected, but natural enough, as this aid to civilisation has not been welcomed widely as an integral part, or even as an adjunct of power stations.

There is nothing in the descriptions of boiler furnaces to lead one to suppose that any advance has been made in the economical combustion of fuel since 1899, and in this matter the book merely reflects the void which it sees. Nevertheless, a word about the improved setting of the Babcock boiler would have enhanced the educative value of this portion of the work. Neither is there any mention of the thermal storage system, which is likely to reduce capital expenditure and works costs by raising the load factor of the boiler plant.

In the first edition, an American firm enjoyed the monopoly of the coal conveyor section, which was dealt with in 3 pages; but the home manufacturers are given a better chance now, and the Temperley transporter finds a place. If there is a fault it lies in so little notice being taken of any but the bucket type of conveyor.

Under generators, we are spared in great measure the dreary pages of outline drawings and arid tables of dimensions, which did nothing to improve the first edition.

The alternating-current generator and transformer section has changed its appearance almost entirely since '99, and has grown also from 42 to 75 pages; but the process of transformation is to be seen at its best under switchboards, which section fairly lives again. If we may say so, this portion of the work is the most intelligent of all, chiefly because all the old growth has been grubbed up, and the new crop is of one sowing. The result provides a section which is in itself a text-book of modern switchboard practice.

For the purposes of the first edition the gas engine did not exist. Here it occupies 62 pages of interesting matter, chiefly descriptive of the leading European engines and producers, and ending with variants of the usual data. Hardly enough is said about the Diesel engine, which is doing good service in a small way, and has been improved in detail since the page of the Pocket-book was written.

We venture to suggest that the 60 pages devoted in the first edition to miscellaneous building data might be cut down from 22 pages in this edition to nothing in the next, for there are so many excellent pocket-books and text-books on building that these few pages of extracts can be spared.

What there is about storage batteries (20 pages) is useful.

In the 11 pages devoted to surface-contact systems, short descriptions are given of those which are well known either through advertisements or use, and the remaining 21 pages of the section are allotted to the conduit system.

Rolling stock has been thickened up to 154 pages. It retains its original American complexion, and reduction to 100 pages, chiefly by the removal of illustrations, would improve this part of the book. No reference is made to any form of radial truck, nor would the reader gather that air-brakes came from England as well as from America; in fact, the subject of brakes has not been treated well. It has been dismissed in 5 pages, and there has been no attempt to compare the various classes of brakes with one another, or to make the bald and cursory descriptions of the two forms of magnetic track brake useful by the introduction of the results of tests.

The data under efficiency, maintenance and depreciation are more or less interesting, according to the temperament of the individual, and the suggestion is admissible that all important fundamental tables should bear the hall-mark of origin and the dates of issue, the latter being particularly necessary if unwary users are to escape the pitfalls which honeycomb the path of those who go about to make estimates for work with which they have an inadequate personal acquaintance.

The last two sections had no place in the first edition. They deal with transmission of power and with alternating-current traction. The former is interesting, chiefly as including a great deal of information in tabular form about the power required to drive tools and apparatus of all kinds; while the latter gets into 36 pages as good a general review of the present extent of single-phase traction as we have seen.

Compared with itself in previous editions, the fourth edition is an advance; compared with other engineering pocket-books it is by no means put to shame, even when the test is for density and quality per cubic inch.

The *Times* has proved what really needed no proof, that the public will keep on buying canned information, however many times it may be re-hashed, and will growl merely at having to re-arrange its box-rooms every time. Mr. Dawson and the compilers of standard technical pocket-books who were before him have had the most comforting proofs that what is true of popular encyclopædias applies equally well to the encyclopædias of every profession or trade. Everyone buys them in the hope that one day they will pour a flood of condensed light on an obscure or debatable point, and pour it quickly; and even when the last edition has not been opened the next is purchased, because one never knows that to-morrow may not bring the occasion when ready information may save the cost many times over. We are creatures of hope.

Precision Grinding. By H. Darbyshire. London: Archibald Constable & Co. 1907. Price 6s. net.

This is a comparatively small book on a very large subject, yet it cannot be said that the subject has been treated in any way in an insufficient manner. The book might have been made many times larger by the inclusion of records of work, but we do not know that the value of a book is always enhanced by being anchored down to a heavy load of what may after all prove but shifting and unreliable sand. For a book, the information in which is bound up with

present day facts, can never become a classic, and a technical book can have but an ephemeral life which deals with present day practice in an art which is in certain respects new and is on the move. We do not mean to imply that grinding is a new operation—it is not, nor is precision grinding a new operation ; but what is new is the use of grinding to remove considerable quantities of material with reasonable accuracy, and subsequently to remove very small quantities so as to obtain an accurately-finished surface. The difference between modern methods and older methods as regards work of ordinary descriptions, is that modern grinding is carried out by means of a highly specialised machine tool. Marvellous work has always been done by Sheffield grinders working on large stones, and with no help from guiding surfaces or rests, but machine shop grinding has to do with work of an entirely different order.

The author of this book has consciously or otherwise had before his mind the classic idea of a book as of something intended to deal, as far as possible, with principles, and, therefore, of some enduring value.

To ensure success in grinding, it is in the first place necessary to employ a good solid and true machine, for all work done by a machine tool partakes of the errors of such tool. This secured, the questions of feed, speeds, of diameters, face and texture of the grinding wheel all require experience to decide them.

There is so much to be learned by experience, and precision grinding is so modern in the engineering workshop, that skilled men newly put to the work will find out all sorts of things that are contrary to their preconceived notions. An improper wheel may become glazed, or it may wear too fast. The very terms of hardness and softness bear a special signification when applied to wheels, for a soft wheel is merely one which has a somewhat loose texture, so that its particles of hard matter are soon torn away, and fresh crystals of the grinding material are exposed at the grinding surface. Therefore it is that a cylindrical piece could not be ground parallel by a single cut of a soft wheel, for the wheel would wear, and the last part ground would have a diameter larger than the first part. Hence, in precision work, a finishing wheel would be harder or closer textured, and would wear little, and would be passed very lightly to and fro over the work, so as to give its final finish with an almost imperceptible cut.

Much of the commercial success of grinding depends upon the finish and degree of accuracy given in the lathe to a spindle, which has then to be hardened before it is ground. Hardening causes more or less distortion, and the amount left for rectifying such distortion must be sufficient, but not more than sufficient.

In the opinion of the author, too little is done by way of grinding plane surfaces, but he regards this operation equally with that of grinding cylindrical surfaces, for a ground surface may be practically finished by grinding, and requires the scraper finish more as a means of assisting lubrication than as improving the truth of surface.

An error in grinding for removal of stock is to feed the wheel along the work too slowly. A wheel ought to travel along the work one breadth of itself for each revolution of the work. The author gives correct reasons for this practice, which is necessary to the best work. For finishing cuts the rule does not apply, but a finishing cut does not demand from a wheel anything approaching its full capacity of output ; the aim is rather to maintain the wheel diameter, and to do this the wear must not be appreciable. In every detail the author appears to have something to say—something practical by way of remedy for every difficulty, and he has filled the whole of his pages usefully and without unnecessary padding.

Engineering in the United States. By Frank Foster, M.Sc. London and Manchester : Sherratt & Hughes. 1906. Price 1s. net.

This work consists of a report to the electors of the Gartside scholarships, which were established at the University of Manchester in 1902. One condition of a scholarship involves the "examination of subjects bearing upon commerce or industry in Germany, Switzerland or the United States of America," followed by a report showing the results of the holder's investigations.

The report under review is of very great interest to those connected with the manufacturing branch of engineering in this country, many of whom will have to relinquish their preconceived notions regarding American methods, if Mr. Foster's conclusions are to be accepted. With reference to this latter point, the age of the author must be taken into account (23 years being the limit) and the short period of 12 months spent in acquiring a knowledge of American practice. It may be mentioned, however, that the first year's work at the University is designed to prepare the student for the investigation in view, and Mr. Foster's report distinctly indicates a careful study of the subjects dealt with ; moreover, many of his conclusions are backed up by instances from undertakings which are of repute even in this country. The author's explanations and solutions of industrial problems are frequently given throughout the book, and they are always interesting, although the conclusions arrived at will not be accepted by every reader of this work.

Chapter 1 devotes considerable space to "specialisation," and it is stated that "there is a strong tendency for a firm, unless very large, to confine itself to one branch of engineering, but the close specialisation which concentrates on one single article is uncommon." With regard to durability, the Americans defend the practice of making their machinery of cheap materials and construction, with a view to an early relegation to the scrap heap when something better is to be had. The old form of apprenticeship so well known in England is said to be almost obsolete in the States ; youths find that they can earn more money than by being tied down to several years' training at a low wage.

As regards labour-saving machinery, Mr. Foster thinks that "owing largely to specialisation in manufacture, its use is somewhat more extended than in England, although there is certainly not that enormous difference between the practice of the two countries that is implied by many writers on the subject."

The relations between employers and employed are dealt with in Chapter 2. The plan of paying for suggestions by workmen for the improvement of workshop methods is not much used, according to the author, and when he attempted to suggest improvements in one shop where he worked, the general foreman would not listen to him, although he had been previously told that suggestions would be welcome. There is no sentiment between masters and men in the States ; "each man is looking for higher wages, and half a cent (a farthing) an hour increase in pay will induce him to change his workshop."

In the author's opinion, "there is not a very great deal of *welfare work* carried on by American firms, yet, in a minor way, a good deal is done towards providing conveniences for the men." The factories are thoroughly warmed in winter, and good lavatory and sanitary conveniences are commonly provided.

The American employer is said to place a higher value upon technical training than obtains in this country.

Under the heading of "Wages and prices" a comparison is made between the value of wages in the States and in England ; Mr. Foster considers that after making due allowance for the higher prices of clothing, house rent, travelling, &c., a workman is almost as well off in England as in America, and he has to work longer hours to the extent of about 5 per cent. With regard to the prevailing impression in this country that the American workman works harder than the British mechanic, the author states that if such be the case, the difference is not very marked. "The office hours are distinctly longer and the concentration is more intense."

Piecework does not appear to be by any means universal in American concerns, even where repetition work is being dealt with. The premium piecework system is used to some extent, but the percentage of firms which have adopted this plan would not appear to be greater than in England. The remainder of Chapter 5 is devoted to the consideration of the piecework system and standard rates of pay.

In Chapter 6, headed "American Engineering Workshops," several items of especial interest to manufacturing engineers may be noted.

Mention is made of the custom in one large electrical works of stopping five minutes before time, to allow the men to wash themselves before leaving. The privilege was, however, subsequently withdrawn, as the majority of the men simply waited round the door for it to be opened.

As regards a site for a new works, most of the larger American firms have laid down their buildings a mile or two from the centres of the large towns. The usual type of shop met with in the States is a fairly lofty building with galleries down the sides and perhaps the centre, but some new works situated well out of town have all their shops on the ground floor. With regard to floors, wood is most common, supported by a layer of concrete. In connection with industrial railways, mention is made of two works where heavy parts are run on trucks to the machines, and are operated upon without removal from the trucks.

Electric driving of machine tools is rapidly ousting the engine drive in most shops; the larger tools have separate motors, and the small ones are grouped and driven by line shafts.

With regard to foundry work, the almost universal practice of using wooden flasks may be noted. Tool stores, as used in English shops, are general, and the workman usually makes a personal application for whatever tools he requires, but in several works messenger boys are provided to save the men's time.

Taking the six chapters reviewed above, as a whole they do not tend to show that American manufacturing practice is in any way ahead of our own, and Mr. Foster's book should effectively check the often expressed opinion that the most up-to-date engineering experience as regards the manufacture of machinery can only be obtained in the United States.

Electric power stations are dealt with in the last chapter.

BUSINESS NOTES.

Dissolutions and Liquidations.—The British Electric Equipment Co., Ltd.—A compulsory winding-up order having been made against this company, the statutory meetings of the creditors and shareholders were held on May 14th at Carey Street, as briefly mentioned in our last issue. Mr. Alfred Robinson attended on behalf of Mrs. Nicholson and the debenture-holders.

Mr. H. M. Winearls, Official Receiver, presided, and he reported to the creditors that the directors had not yet filed the statement of affairs, but Mr. Burton, chartered accountant, on their behalf, had furnished an approximate statement showing unsecured debts £7,305; fully secured creditors (Coutt's Bank) £6,149, the security being the guarantee of Mr. and Mrs. Nicholson; a partly secured creditor (Mrs. Nicholson) £9,683, holding securities valued at £7,152, and consequently unsecured for the balance of £2,532; and loans on debenture bonds £2,000. The assets consisted of stock-in-trade, £595; cash, £6; good book debts, £178; and doubtful and bad debts, together amounting to £255, but only expected to yield £75. Then there were the amounts due under the various contracts with town and district councils, but they were all claimed by Mrs. Nicholson under charges given to her at different times. The practical result was that there was absolutely nothing left for the unsecured creditors or the shareholders. The deficiency in assets to meet the company's liabilities was returned at £9,837, and the total deficiency to the contributories was estimated at £23,944. The company was registered in November, 1904, with a nominal capital of £40,000 to acquire from Mr. Hugh Godfrey Nicholson, the business of electrical engineers and contractors formerly carried on at 11, Queen Victoria Street, E.C., under the style of the British Electric Equipment Co. The Board consisted throughout of Mr. H. G. Nicholson, who had been the managing director at a salary of £1,000 a year, and his brother, Mr. Victor Ralph Nicholson, who had not received any remuneration. On November 11th, 1904, the company entered into an agreement with Mr. H. G. Nicholson for the purchase of the business, for £15,215, payable as to £7,215 in cash and £8,000 in fully-paid ordinary shares. The vendor's shares were duly allotted, and still stood in Mr. Nicholson's name; 100 shares were allotted to his brother, and had been paid for in cash; 6,000 shares had been allotted as 5 per cent. cumulative preference shares, and were paid for in full; and 7 signatories' shares were allotted and paid for in cash—making a total issue of £14,107. With regard to the 6,000 preference shares, they were allotted to a Mr. John Cleland and paid for by that gentleman; but the amount of his investment was guaranteed by Mrs. Nicholson, who charged some property at Balham for payment of the amount. The business acquired by the company was commenced at the end of 1902 by four gentlemen, for whom Mr. Nicholson acted as chief engineer. In June, 1904, Mr. Nicholson purchased this business—for what consideration had not as yet transpired—but it appeared that of the purchase price of £15,215 no less than £10,000 must have been represented by the goodwill. The articles of association, however, were so framed that no question could be raised upon the amount paid for the business. It consisted of carrying out engineering contracts in connection with electric tramways for various town and district councils, and had been financed throughout by Mrs. Nicholson. The following is a list of the charges executed in that lady's favour:—

(1) November, 1905: Book debt due from the Glasgow Corporation to secure repayment of a loan of £1,636 advanced on November 18th, 1905.
(2) October, 1906: Book debt due from Leyton District Council to secure a guarantee of repayment of a bank loan of £1,800. Under that guarantee Mrs. Nicholson paid £1,767 last April.
(3) October, 1906: Book debt due from Walthamstow District Council to secure the guarantee of a bank loan of £2,500.
(4) January, 1907: Book debt due from Leyton District Council to secure repayment of two loans by Mrs. Nicholson of £800 and £700 respectively.
(5) January, 1907: Book debt due from Yarmouth Town Council, the consideration being the guarantee of repayment of a bank loan of £2,000, and under which Mrs. Nicholson claimed £1,400.
(6) January, 1907: Another book debt due from Yarmouth Town Council to secure the guarantee of an overdraft of £1,300 at the bank. Under that guarantee Mrs. Nicholson claimed £1,248.
(7) February, 1907: Another book debt due from the Walthamstow District Council to secure the repayment of £990 lent by Mrs. Nicholson.
(8) February, 1907: Book debt due from the Barking District Council to secure repayment of a similar loan of £400.

These charges on book debts did not require to be registered at the Joint Stock Registry under Section 14 of the Companies Act of 1900, and consequently the creditors were not afforded the opportunity of ascertaining the exact position of the company before giving it credit. Until a month or two ago no register of mortgages was kept by the company. The circumstances under which these charges were given to Mrs. Nicholson would require very careful investigation. All those given within three months of the winding-up order were *primâ facie* bad, except to the extent of which actual cash was advanced at the time that the charge was executed, unless it could be established that Mrs. Nicholson agreed to make further advances in consideration of her previous advances, not hitherto secured, being guaranteed at the time. In addition to those charges on March 20th, 1907, only six days before the commencement of these liquidation proceedings, £2,000 5 per cent. mortgage debenture bonds covering the whole of the assets of the company were issued to Mrs. Nicholson to secure an advance of £500 made on March 23rd, a previous advance of £1,000 on April 30th, 1906, and an advance of £500 on May 2nd, 1906. Unless it could be clearly established that Mrs. Nicholson only made, or agreed to make, that immediate advance of £500 which was essential for the benefit of the company, and as a condition of making that advance she insisted upon her previous advance being guaranteed, *primâ facie* to the extent of £1,500 those mortgage debenture bonds were bad. As soon as these debentures were issued she transferred them to third parties, and although they might be bad in the hands of Mrs. Nicholson they might be held to be good in the hands of third parties. That gave rise to other considerations because, if the directors had not acted in the interests of the company solely, there might be a claim against them personally in respect of the issue of debentures under those circumstances. When the bonds were issued Mrs. Nicholson agreed that, so far as the assets might not be sufficient to meet those debentures, she would postpone the charges which she held so long as the debentures were held by the persons to whom she had transferred them.

Mr. Nicholson's account in the company's books had been very imperfectly kept. At the date of the winding-up order it showed him to be a debtor to the extent of £5,000, but he had since lodged further accounts which reduced the debt to £86. Those accounts would require very careful investigation, and it appeared that two items, for which he took credit in bringing down the indebtedness, were an estimated sum of £800 for personal expenses, and £1,000 in respect of his liability to repay the overdraft at Coutts's bank.

A creditor asked what had become of all the money handled by the company. Had they transacted their business at a loss?

The Chairman pointed out that book debts to the amount of many thousands of pounds due under the company's contracts had been charged to Mrs. Nicholson.

Asked to explain how the deficiency of £10,000 had arisen, Mr. Nicholson said a loss had been made on the various contracts undertaken by the company. There had been some 15 or 16 contracts, and they had generally resulted in a loss. There was between £2,000 and £3,000 lost at Walthamstow, and a similar amount at Dover. He had acted as chief engineer.

A creditor: And you drew £1,000 a year for advising the company to take these losing contracts?—No, not at that time.

A wish was expressed by another creditor that a return should be furnished showing the amount at which they were taken and the expenditure incurred in executing them. It was only reasonable that documents should be supplied, having regard to the peculiar formation of the company.

The Chairman said he would endeavour to supply the desired information.

A creditor challenged Mr. Nicholson to say whether, before he signed the Walthamstow contract, it was pointed out that it was clear, from the work already done there, that the contract could only be carried through at a loss; whether he was advised not to sign the contract, but signed, saying that he could do it at a profit.

Mr. Nicholson replied that in signing the contract he relied upon his engineer's figures. He did not go into the contract personally, because he had full confidence in that man's long experience.

The creditor: As engineer and managing director of the company, you surely ought to have personally looked into the contract.

Mr. Nicholson: I am afraid I do not recollect anything about it.

Were you not aware that this company was insolvent beyond all hope twelve months ago?—No; I was not aware of it.

Asked if there would be a sitting for the public examination of the directors and officials of the company at which all the circumstances would be fully investigated, the Chairman replied that he could not express any opinion on the point at present.

The Chairman remarked that he had omitted to mention that on April 9th Mr. Burton, who was a chartered accountant carrying on business at Copthall Avenue, E.C., was appointed receiver and manager on behalf of the debenture-holders, and he had since carried on the business with a view to completing the outstanding contracts.

Mr. W. T. Graves, the secretary of the Improved Wood Pavement Co., said they had met under somewhat unfortunate circumstances, and could not be expected to feel much sympathy with the directors and others concerned. The present position was not due to misfortune or badness of trade, but, to state it mildly, to bad management. He proposed that the liquidation should be left in the hands of the Official Receiver, and a substantial committee of inspection.

The Chairman observed that if it proved to be necessary to take proceedings to attack the charges and debentures, it would be essential to consult some of the largest creditors. He accordingly suggested that the meeting should nominate some from their body to act as a committee of inspection.

Resolutions were unanimously passed for the Official Receiver to act as liquidator, and for the following gentlemen to assist him as a committee of inspection, viz.; Mr. W. T. Graves (Improved Wood Pavement Co.), Mr. A. C. Davis (Saxon Portland Cement Co., Ltd.), Mr. W. J. Higgs (James Russell & Sons, Ltd.), Mr. W. H. Chappell (Brooks, Ltd.), and Mr. Fernand Espir, representing the Havre Copper Wire Works and other foreign creditors.

In the absence of a quorum, the meeting of shareholders was formally adjourned until this week, after which, if no resolution be passed, the resolutions of the creditors will be acted upon.

Witting, Eborall & Co., Ltd.—Creditors are to send the usual particulars of debts, &c., to the liquidator, Mr. S. C. Witting, 49, Cannon Street, E.C., by July 31st.

Cowper-Coles Metal Extraction Syndicate, Ltd.—Creditors must send particulars of their debts, &c., to the liquidator (Charles Hammond, Hayle, Cornwall) by July 1st.

The Standard Gas Fittings Co., gas and electrical fittings manufacturers, Beaumont Works, St. Stephen Street, Birmingham.—Messrs. C. H. Twigg, W. Rogers, C. W. Cooke, and A. W. Rogers have dissolved partnership, Mr. C. H. Twigg retiring.

Conduit Enamel.—From Simplex Conduits, Ltd., we have received a thin piece of tin coated with their flexible conduit enamel. It certainly requires a great deal of bending to make any impression on the enamel.

Trade Announcements.—In connection with a case tried before Mr. Justice Lawrance last week, in which it was stated that a young man was induced to take up certain shares in the *South African Engineer* Co., Ltd., we are asked to point out that *South African Engineering*, of 392, Strand, W.C., is not connected in any way with the *South African Engineer*. Certain of the morning papers, in error, gave the name as the *South African Engineering* Co., Ltd., and we insert this note to help remedy the confusion thus caused.

The Phœnix Electric Heating Co., Ltd., announce that their showrooms, stores and head office are removed to Phœnix Works, 17, Morwell Street, Tottenham Court Road, W.C.

The Maxim Electrical Co., Ltd., have removed their head offices and stores to Parliament Chambers, Great Smith Street, Westminster, S.W., where all letters should be addressed. The company is providing increased facilities for the manufacture of its Maxim arc and incandescent lamps at new works which will shortly be opened at Walthamstow. A number of illustrated sheets have been issued by the company, showing specimens of lighting done by their arc lamps in tube railways and for shop interior and showroom illumination.

Messrs. S. W. Martyn & Co., have taken works and offices at 11, Pratt Street, Camden Town, London, N.W., which they have brought thoroughly up-to-date, and have started in business there as electrical and motor-car engineers, under the management of Mr. Sarsfield W. Martyn, A.M.I.E.E., A.M.I.Mech.E. They are now placing a number of new patent specialities on the market, including a cable connector, a water-tight fuse and a motor-car terminal.

The Consolidated Accessories Co. have removed from Craven House, Kingsway, to more convenient offices at 27, Clement's Lane, E.C. We are asked to state that the business of the company has been under the control of Mr. J. McI. Cater since November last, in place of Mr. H. C. King, whose connection with the company then ceased.

The Armorduct Manufacturing Co., Ltd., have just purchased a freehold building site, extending to some 7 acres, at Witton, Birmingham, where they propose to erect large new works, in which the whole of their manufactures will be concentrated.

Book Notices.—*The Week-End and Holiday A.B.C.*—This is the first issue of a sixpenny monthly, which purports to be, and is, a concise and useful hand and guide-book to places within easy reach of London, Liverpool, Manchester, Birmingham, Bristol and Leeds, "where may be found amusement, sport, relaxation, rest and repose." Train information, and particulars of week-end motor and sea trips, sports and amusements calendar, week-end cottages, the golf links round London—these references are sufficient to indicate the character of the contents.

Taxes on Catalogues.—Considerable inconvenience and loss has been caused to British manufacturers on account of the recently-imposed taxes levied by some British Colonies on catalogues received through the post. Confusion has arisen both in regard to the nature of the packages to be taxed and the methods of collecting the taxes. In some cases there exist no reasonable facilities for paying the duties before the packages are posted, and this has resulted in a very large number of catalogues being undelivered and returned or destroyed. We are informed that during the past few months the Manufacturers' Association of Great Britain have received several hundreds of inquiries from members and others in regard to the matter, and that that body are now making representations with a view to inducing some of the Colonial Governments to adopt more convenient methods of collecting these taxes. Meanwhile, the Manufacturers' Association have prepared a memorandum respecting tariff duties for the guidance of manufacturers, from which the following information on the subject is taken:—

In agreement with the Customs Union Convention of 1906, there is a common tariff for the Cape of Good Hope, Natal, Orange River Colony, the Transvaal and Southern Rhodesia, under which the duty on catalogues, price lists, &c., has been fixed at the rate of 25 per cent. *ad valorem*, or 2d. per lb., whichever may be the greater, except when the packets are less than 8 oz. in weight, in which case they enter free. The tax is collected as a surcharge, there being no arrangements at present for paying it in Great Britain, and the best method to adopt when forwarding catalogues through the post is to remit the duty on each packet to the Postmaster-General in the capital town in each Colony, and mark the package "Duty paid to the Postmaster-General." As, however, English stamps will not be accepted in payment of duty, a postal or money order must be remitted.

The Australian Colonies have one common tariff, under which catalogues, price lists, &c., are charged with a duty at the rate of 3d. per lb. The duty is waived on all packages sent through the post which do not exceed 4 lb. in weight. On packages heavier than 4 lb., duty should be remitted by postal or money order to the Deputy Postmaster-General of the State to which catalogues &c., are addressed, and each package marked as above mentioned; if this is not done, the duty will be collected as a surcharge.

The duty on catalogues sent through the post to Canada is 5d. per lb., and those requiring to prepay the duty can do so at any district post office in Great Britain.

There is no tariff duty on catalogues sent by British firms (other than printers) to New Zealand, excepting on leaflets and circulars sent out in quantity for distribution.

Where a large number of catalogues are required to be distributed in any particular Colony, the Manufacturers' Association recommend that catalogues should be forwarded in bulk to an agent on the spot, who should be requested to pay the duty and re-post them locally.

New Zealand International Exhibition.—Messrs. Wm. Asquith, Ltd., High Road Well Works, Halifax, have been exhibiting one of their Radials at this exhibition. The machine, which has a maximum spindle radius of 4 ft., is of their latest box-bed type, fitted with gear speed and feed-boxes. We understand that it has been shown in operation, using high-speed twist drills, and has attracted great attention amongst engineering visitors. It has been awarded the gold medal.

Bankruptcy Proceedings.—G. Collier.—An application was made to Mr. Registrar Giffard on Wednesday, May 15th, at the London Bankruptcy Court, on behalf of George Collier, gas and electrical engineer, 89, Long Acre, W.C., trading as H. Collier & Co. Mr. W. P. Bowyer, assistant receiver, reported that the bankrupt failed in February last, with provable debts £727; the assets valued at £214 18s. 10d. had realised £101 9s. 7d., and a further £35 would probably be received. The offences alleged by the Official Receiver were (1) insufficiency of assets to pay 10s. in the £ to the creditors; (2) imperfect book-keeping; and (3) trading with knowledge of insolvency. His Honor upheld the Official Receiver's report, and imposed a further suspension of two years and a half. Order entered accordingly.

Francis Williams, electrician, Bemerton.—A meeting of the creditors was held at Salisbury, on May 16th; the gross liabilities amount to £285, and the unsecured liabilities to £277. The assets are estimated to realise £23, leaving a deficiency of £254. The estate remains in the hands of the Official Receiver.

Russia.—The Acting British Vice-Consul at Baku (Mr. McDonell), writing in regard to possible openings for British trade in his district, notes a demand for electrical appliances of all kinds, not only for electric lighting plants, but also for drilling and pumping machinery for the oil-fields. The great advantage of the use of electricity is the economy in space, the power being supplied from the central power station, and the erection of an extensive and cumbersome boiler plant is thus avoided where the land is required for drilling. It also has the advantage of cleanliness. All electrical plant is at present supplied from Germany.—*The Board of Trade Journal.*

Ceylon Rubber. — The *Financial News* says that Ceylon has 100,000 acres of land planted with rubber.

Wolfram Lamps.—It is reported that the Wolfram Lamp Co., of Augsburg, does not propose to pay any dividend for the first year of its existence. The company intends to make an increase in the share capital for the purpose of acquiring the Bavarian incandescent filament factory of G. Ludecke & Co., at Augsburg-Leckhausen.

The Ganz-A.E.G. Agreement.—It is announced from Buda Pesth that the community of interests which was established a year ago between the Ganz Co. and the Allgemeine-Union Co., and which led to the formation of a special company with a share capital of £333,000, has been dissolved. The reason for the rupture is said to lie in various differences which have recently risen, and which have rendered a further community impossible.

Tramcar Lifeguard Invention.—The Dresden Town Council, as far back as 1903, offered a prize of £500 for the best contrivance for protecting persons from being run over by electric tramcars. No fewer than 400 competitors entered the list, and after tests extending over two or three years, the lifeguard devised by Herr Bruno Helbig, of Dresden, is declared to be the best. The inventor has been awarded the sum of £200, as two other protective systems have also been considered out of the total amount allotted for prize distribution. The apparatus given the first prize has been tested on the Dresden-Laubegast section of the tramways, and, as it has fully answered expectations, it is proposed to equip further cars with it. The guard has picked up two dogs and a bottle of beer without damaging them, and both by day and night, and in all positions, numerous tests have been made with a life-size leather doll.

Catalogues and Lists.—Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Illustrated catalogue, 36 pages, of electric light accessories, including wires, cables, casings, steel conduits, lamps, &c. Small "tangent" motors are also shown. Prices are very boldly printed.

The Sterling Telephone and Electric Co., 200 Upper Thames Street, E.C.—This is a finely-produced catalogue (85 pages), in which is clearly illustrated and briefly described a very wide variety of electric bells and bell accessories, including such things as indicators, pushes, fire alarms, batteries, wires, wiring sundries, domestic telephones for use on bell circuits, water level indicators, hotel signalling systems. Prices are clearly stated, and there is a convenient telegraphic code at the end of the book.

Messrs. Marples, Leach & Co., 6, Victoria Avenue, London, E.C.—New polyphase motor list (No. 102A) just issued. Its 36 pages contain descriptions and a great deal of tabulated matter concerning different types of three-phase motors, rheostats, flexible couplings, code, words dimensional particulars and diagrams of connections for two and three-phase motor are also given. The list covers motors from ⅛ H.P. at 1,400 R.P.M. to 300 H.P. at 365 revolutions. The short-circuited rotors are made under a patent principle, inasmuch as the electrical circuit in the rotor has no joints, the windings being cut from the solid metal, and slipped into place. The motors with wound rotors are provided with a brush lifting and short-circuiting device. By means of this device the brushes on the slip rings can be raised after the motor has been started, the rings being short-circuited by the same operation. Wear and tear of the slip rings, brush gear and brushes, is thus eliminated, and the efficiency of the motor improved. Motors equipped with this device are claimed to thus combine the advantages of the slip-ring motor at starting, with those of the short-circuited motor while running. The operation of short-circuiting the slip rings and lifting the brushes is performed in one motion by means of a lever, arranged in such a way that no mistake of any kind can occur.

Messrs Julius Sax & Co., Ltd., 100, Charing Cross Road, W.C.—Catalogue of voltmeters and ammeters of the "Julius Sax" industrial type for D.C. and A.C. circuits, just being placed on the market. Dimensional drawings and tabulated particulars of catalogue numbers, prices, &c., are given.

W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, E.C.—A number of lists have just been issued, all containing brief particulars, diagrams and prices:—No. 102 devoted to pavement frames and covers; No. 103 to joint-box compounds; No. 104, wall type dividing boxes; and No. 105, Reader's patent house service boxes.

Messrs. Imeson Bros., Finch & Co., of Stockton-on-Tees, have recently placed upon the market a new ear, which we understand has been successfully tried by several tramway companies. It is the subject of an illustrated leaflet just issued. The object of the ear is to overcome the difficulty experienced in screwed ears; it is attached by means of powerful spring clips, which are chemically prepared to withstand the atmospherical effects, and the trolley wire can be immediately released or replaced.

The Wilson-Wolf Engineering Co., Ltd., Thornton Road, Bradford.—Folding-card price list of "Arctic" ventilating fans for the current season. The list has been compiled for the use of contractors and wholesale dealers. Box-blade and port-hole types are particularised as to consumption and capacity, &c. The fans are made up to 48 in. diameter, and standard voltages can be delivered from stock. Copies of the list, also of complete catalogue, can be obtained on application.

LIGHTING and POWER NOTES.

Ashton-under-Lyne.—The E.L. Department shows a profit of £1,900 on the year just ended. This has been the most successful year since the works started.

Blackpool.—The Markets and Street Lighting Committee of the T.C. has decided to light all the principal squares and open spaces in the town with the yellow flame arc lamp.

Barnes.—Up to May 1st 47,366 private lamps had been connected to the mains. The L.G.B. has sanctioned a loan of £6,700 for the purpose of the electricity undertaking, repayable as to £5,700 in 17 years, and the balance (£1,000 for meters) in five years. The profits of the year's working amounted to £2,467 after provision had been made for interest on loans and repayment of principal.

Blackburn.—The Electricity Department of the Corporation earned a total income for the past year of £32,078; the total working expenses were £15,177, and the net profit £1,528. Last year there was a net profit of £276. The capital expenditure to date is £352,817, and £202,641 represents the amount of loans outstanding. Loans paid off amount to £49,130.

Burnham (Somerset).—It was announced at a meeting of the U.D.C. on May 14th that the promoters of the E.L. scheme had withdrawn their application for a prov. order.

Chester.—The aggregate income of the Corporation electricity works in 1906 was £16,843, an increase of £143 on 1905, and the total expenditure £8,554, against £7,664 in 1905. There is an apparent surplus of £1,225. The unexpended balance of capital account is now £4,817, and the capital outstanding amounts to £94,033.

Chichester.—The E.L. company has informed the T.C. that its capital subscribed is £13,000, and that £6,500 is paid up. With a view to the E.L. order being transferred to the company, this information is to be forwarded to the B. of T.

Droylsden.—The Council has applied to the Manchester Corporation Electricity Department, to know whether the latter intends to carry out its obligations under the Droylsden Electric Lighting Order of 1897, on the transfer of the electric lighting undertaking of the Droylsden Council to the Manchester Corporation.

Dundee.—A local paper states that the Panmure shipyard is being electrically equipped by the British Westinghouse Co.; energy will be obtained from the Corporation.

Dunfermline.—It has been agreed to get a final report on the electric supply question from Mr. Buchan, of Buchan & Partners, electrical engineers, Edinburgh. The question has been before the Council for two years, and there is a strong desire that a decision may soon be arrived at.

Exeter.—The Lighting Committee recently issued the following figures relative to the growth of the undertaking in the ten years ending March 31st last:—Number of consumers 1,022, against 164 in 1897; lamps connected 60,000, against 8,000; units sold for light, power and tramways 1,193,233, against 143,000; revenue from supply and meter rents £15,902, against £3,538. Consumers connected now include:—For lighting, about 400 private houses, 550 business premises, 25 public buildings, and 20 places of worship; for power: about 80 premises for driving machinery, printing, organ blowing, lifts, fans, &c.

Harrogate.—At a meeting of the T.C. on the 13th inst., Mr. Stott, chairman of the Electric Light Committee, gave a review of the ten years which have elapsed since the establishment of the undertaking. He said that at the end of the first year the Corporation had 120 customers on their books; they now had 1,347. In the first year the revenue was £371; last year it reached £16,905, and a loss of £1,269 had been turned into a profit of about £2,000. During the ten years £11,542 had been handed over for the relief of the rates.

Hucknall Torkard.—The U.D.C. has applied to the B. of T. for an extension of the E.L. order.

Leigh.—The annual report of the electricity department shows that there has been a loss on the year of £407, as against a profit of £219 in 1905. The number of consumers has increased from 279 to 315, and the number of units sold from 629,181 to 702,119. The loss on the year's working is owing to the repayment of the first instalment on a loan of £14,365, which has made an extra charge on the department of £628.

Leeds.—The draft revenue account for the year ending March 31st last, submitted to the Committee, shows a substantial growth in the sales of current, and the additions to the lamps and motors installed on consumers' premises are also considerable. The results of the past two years' work were as follows:—

	1905-6.	1906-7.
Total revenue	£94,256	£108,259
Working expenses	28,306	32,468
	£65,950	£75,791
Extraordinary renewals	3,495	14,272
Gross profit	£62,455	£61,519
Income-tax, interest and redemption fund	59,210	58,109
Surplus carried to reserve fund	£3,245	£3,410
Units sold	9,197,259	11,368,956
Average price per unit	2·46d.	2·28d.
Expenses per unit, including extraordinary renewals, interest and sinking fund	2·38d.	2·21d.
Surplus per unit	0·08d.	0·07d.

Although the surplus is very little more than last year, the amount chargeable in respect of extraordinary renewals of machinery (owing to the sale of engines which had become useless

to the Corporation) is no less than £14,272; and this amount, with the £3,409 transferred to the reserve fund, makes a total set aside for replacements of plant (other than ordinary repairs and renewals) and other contingencies of £17,681. The reserve or equalising fund now amounts to £17,006. For street and private lighting there were sold in 1905-6 and 1906-7, 5,785,383 and 6,498,014 units respectively, the average price per unit obtained being 3·18d. and 3·09d respectively. The aggregate H.P. of motors installed at March 31st, 1907, was 6,830, as against 5,471 in the previous year, being an increase during the year of 1,409 (25·8 per cent.). For the two years 1905-6, 1906-7, the power units sold were 3,411,876 and 4,870,942; the average price per unit obtained was 1·25d. and 1·21d.; the units sold per H.P. installed, 751 and 796; and the revenue per H.P. installed, £3 18s. and £4 respectively. The improved load factor consequent upon the increasing proportion of the output used as motive power has again resulted in a considerable reduction in the cost per unit of electrical energy sold, and also in the average price charged to consumers. The following statement shows the comparison for the past two years:—

	1906.	1907.
Total working expenses per unit	·73d.	·69d.
Special charges	·01d.	·00d.
Extraordinary renewals	·09d.	·30d.
Interest	·80d.	·59d.
Redemption fund charges	·75d.	·63d.
Total charges per unit	2·38d.	2·21d.
Surplus profit per unit	·08d.	·07d.
Average price obtained	2·46d.	2·28d.
Load factor	17 %	18 %

The interest and redemption fund charges last year amounted to practically 1¼d. per unit, or 55 per cent. of the total cost, whilst, including the cost of extraordinary renewals of plant, which may be regarded as in the nature of a charge for depreciation, the total capital charges are over 1½d. per unit, or 68 per cent. of the total. The sales of plant already mentioned have reduced the capacity of the alternators at the generating station from 11,340 KW., to 10,440 KW., but a steam turbo-alternator of a capacity of 3,000 KW. is on order, and is expected to be available for use before the close of the present summer. The maximum load upon the plant during the year was 7,470 KW., compared with 6,730 KW. in the preceding year.

Lees (Lancs.).—Oldham T.C. has informed the U.D.C. that it has no power to accept a transfer of the E.L. order.

London.—STEPNEY.—The Electric Lighting Committee reported on Tuesday with reference to the scheme for the future supply, that it had come to the conclusion that before actually inviting tenders, the advice of an engineer of eminence should be obtained upon the scheme as prepared by the borough electrical engineer. It seems that a re-arrangement, and possibly an augmentation, of the staff now engaged at the Osborn Street station will become necessary; further, it is thought that definite terms of remuneration should be arranged with the borough engineer. With reference to the L.C.C. (Electric Supply) Bill, the Committee had come to the conclusion that the measure as now drafted had in it no promise of any better conditions than those foreshadowed in the Bill as originally introduced, with regard to the compulsory acquisition of the undertakings of the Metropolitan Borough Councils, but on the contrary was calculated to aggravate the dangers to the Council's undertaking should the Bill become law, and it was of opinion that the Council must proceed therefore with its opposition to the Bill.

STOKE NEWINGTON.—The agreement with the Hackney Borough Council for electricity supply terminated on April 30th, and the change over of the High Street supply to the Stoke Newington Council's mains was effected on May 1st.

ISLINGTON.—The B.C. is to convene a conference of representatives of the Metropolitan Borough Councils, who are electric light undertakers, with a view to securing the reintroduction by the Board of Trade of the Supply of Electricity Bill.

Luton.—The Electric Light and Power Committee reported that the net profit for the year ended March 31st, 1907, was £863, and resolved to allocate this as follows: District fund account, £483; reserve fund, £200; purchase of meters (one year), £230.

Middlesbrough.—The much discussed agreement between the Cleveland and Durham Electrical Power Co. and the T.C. recently came up for confirmation, with a recommendation that it should not be made public. An amendment that it should be referred back was lost, only five voting for it. It was stated that the agreement would obviate the spending of nearly £12,000 on plant to meet next winter's load, and that the T.C. would, in addition, receive £1,000.

Newport (Mon.).—A L.G.B. inquiry was held on May 14th into the application of the T.C. for a loan of £30,000 for E.L. purposes, £20,000 being for mains extensions, and £10,000 for additional plant. There was no opposition.

Rhondda.—An electrical equipment, costing some £150,000 and including winding plant, is being provided for the nine pits under the management of Messrs. David Davies & Sons; Mr. W. H. Patchell, of Westminster, is consulting engineer for the scheme.

Southampton.—A L.G.B. inquiry was held on May 14th into the application of the T.C. for a loan of £17,000 for E.L. purposes. There was no opposition.

South Africa.—JOHANNESBURG.—The municipal electric supply still continues in a very erratic state, and meantime there is a very noticeable falling off in revenue, besides the great inconvenience to the public, through the failure of supply to both trams and lighting. The result of the Coroner's inquest over the recent fatality due to "gassing" has brought to light an alarming state of affairs. One witness stated that there had been 63 cases of "gassing" in the past six months, one-half of which took place in the last month, and on April 15th nearly the whole of the power station staff was overcome. The escape of gas is chiefly due to defective exhaust chambers and insufficient ventilation, though every effort is being made to remedy these defects. In the course of his remarks, the Coroner said that "unless the defects are remedied immediately, the only course appears to be to close down the power station altogether."

At a mass meeting of the ratepayers on Saturday, April 20th, municipal matters in general were reviewed, and a resolution was passed asking the Government to appoint a Commission to investigate matters. In referring to the Tramway and Lighting Department, it was stated that it was over-staffed, the number of whites employed being 451, and natives 803, the office staff was 55 for the general manager's department, 20 for the traffic manager's department, and 16 for the treasury department; a grand total of 1,350.

Victoria.—MELBOURNE.—We gather from the *Electrical Record*, that Mr. W. Thwaites, engineer-in-chief of the Melbourne and Metropolitan Board of Works, has distributed a circular outlining a scheme for the generation of electricity at Dight's Falls, to supply Melbourne and neighbourhood. Mr. Thwaite points out that the falls are as nearly as possible in the centre of the metropolitan area, and that bulk supply could be given at 6,600 volts to private consumers, tramways, &c., at a cheap rate, possibly 1d. per unit. The Melbourne tramways are now worked from 11 stations, but when they become the property of the municipalities they could more profitably be worked from one plant. The station could be built for the municipalities conjointly by the Metropolitan Board of Works, which would control the water rights.

Wadebridge.—The U.D.C. has decided to obtain an estimate for an E.L. installation for the town.

Wakefield.—A notice signed by the chief electrical engineer to the Corporation, has been posted at the electricity works, stating that, "In consequence of the recent trouble and general upset of the smoothness of the station, occasioned by the friction between non-union men and union men, it has been definitely decided that on and after May 30th, no union men will be employed, and should any of the employés be desirous of retaining their posts, they may do so by handing in their names to the undersigned.—H. A. Nevill." Mr. Nevill expresses his intention to conduct the works independently of trade union interference.

Walsall.—The Finance Committee of the Corporation has decided to lend £10,000 to the Electricity Committee for the purpose of extending and improving the electricity undertaking.

Walthamstow.—Recently the Council asked the L.G.B. to receive a deputation with regard to certain surcharges in connection with the electric lighting undertaking. A reply has now been received from the L.G.B, saying that it cannot see its way to alter the decision with reference to the disallowance of the items.

West Bromwich.—The annual report on the electricity undertaking of the Corporation states that during the past year the borrowing powers have been increased by £5,150, whilst the capital expenditure has been increased by £4,993. The net debt on the undertaking, after deducting the amount in sinking fund, was, at the close of the year, £60,793. There has been an increase of 30 consumers during the twelve months. In connection with the sales of energy there is a steady increase in all departments, excepting that of tramways, which has decreased by £139. The gross profits on the sale of electrical energy amounted to £6,248 for the year, against £5,673 last year. The net profits of the undertaking amounted to £2,624, as compared with £1,931 last year.

Yarmouth.—A scheme to supply outside arc lamps on the maintenance principle, the wiring and fitting to be sublet to local contractors, is being considered by a Committee of the T.C.

TRAMWAY and RAILWAY NOTES.

Bolton.—The length of tramway between the military barracks at Bury and the boundary of the borough of Bolton has been completed and opened for traffic. Bolton is now in direct communication with Yorkshire by tramway.

Continental Notes.—AUSTRIA.—It is announced that Count Paul Szapary, and engineer Emil Torok, in conjunction with the Detroit Construction Co. and the International Railway Co. of the United States, have lodged an application with the Ministry of Commerce at Buda Pesth for the granting of a concession to construct a main line of electric railway between Vienna and Buda

Pesth, and for the building of a local line at the latter city. The latter would be in part an underground railway, and be installed on the Nove system devised by Mr. B. Nove, the vice-president of the Detroit Construction Co. It is said that the International Railway Co. is prepared to invest $25,000,000 in the undertaking. The applicants for the concession will also approach the Austrian Government in so far as the main line affects that portion of the dual monarchy. The scheme for the construction of an electric railway between Vienna and Pressburg, which was long ago approved for the Austrian section, has just been rejected by the Economic Committee at Buda Pesth for the Hungarian section.

Moscow.—The municipal authorities have contracted with an English firm for the construction of several tramways. The scheme, including three power stations which will be built, will cost 10 million roubles (£1,000,000), and the money is to be raised by a municial loan.—*Reuter.*

Dundee.—The tramway receipts for the year amounted to £57,672, or £7,518 over the previous year. Within the short period of two years, the gross receipts have gone up £13,000, or about 30 per cent. The working expenses for the year will amount to about £36,000, leaving a gross profit of £21,000. Although the mileage has been increased, fares all round were reduced during the past year.

Leeds.—The Tramways Committee had before it on the 13th inst. financial matters concerning the present year. This year the Committee has to face a large increase of about £5,000 in the cost of renewal of permanent way. There will also be a very considerable advance in the cost of materials, largely due to the fact that coal is much dearer, but, notwithstanding this additional expenditure, a net profit of £48,000 will, it is estimated, be available for the relief of the rates. Already in the first six weeks of the financial year the receipts are £2,680 in excess of the corresponding period of 1906.

The question of establishing a parcel-carrying system is still being considered by the committee.

London.—L.C.C.—The Postmen's Federation has protested against the action of the L.C.C. in recommending the alteration of the hour for the issuing of workmen's tickets on its tramways from 1.30 a.m. to 3.30 a.m., as it will inflict a very great hardship upon employés of the postal service, printing trades, and other early morning workers.

Luton.—The T.C. has decided by 12 votes to nine to sanction the running of the proposed electric tramcars on Sundays.

Morecambe.—Recently the Corporation called in Mr. Gardner (manager of Chester tramways) to give expert advice on the electrification of the Morecambe tramway system. As a result, a scheme is to be prepared in accordance with his report.

Richmond.—At the last meeting of the T.C., recommendations from the Tramways Committee were considered in favour of allowing the London United Tramways Co. to install the overhead system of electric traction in the Kew Road. It was also recommended that the company be requested to promote a Bill for authorising the construction of tramways over Kew Bridge. After prolonged discussion, during which it was pointed out that the proposals were a complete reversal of the tramway policy of the majority of the Council for years past, an adjournment was decided upon to allow members time to inspect plans and sections submitted by the company, and in the meantime the views of the frontagers in the Kew Road are to be obtained on the question of overhead wires in place of the conduit system, as provided by the agreement of 1902.

Shoeburyness.—The U.D.C. has decided not to consent to the application of Southend T.C. for an extension of time for completing the tramways to the town.

Surrey.—At a meeting of the Surrey C.C. a recommendation was put forward by the Parliamentary Committee to the effect that the Council should oppose the L.U.T. Co.'s Bill, in view of a communication which had been received from the Esher and Dittons U.D.C., stating that the existing terminus of the tramway, which was contiguous to the approach of the Window's Bridge, on the Surbiton side, had increased the necessity for its widening. It was mentioned that the company had agreed to widen the bridge at an early date.

Torquay.—The Dolter Co. is anxious to extend its system of electric traction in Torquay and the neighbourhood. The company will shortly apply to the T.C. for permission to lay the Torbay track, and will, it is announced, promote a Bill in Parliament next session to extend the tramway to Paignton. If these applications are successful, the financial prospects of the company will be considerably improved; the present returns scarcely meet expectations. The Council is, we believe, under agreement with the company to permit the extension from the centre of the town to Torquay station, *vid* the Torbay road, as soon as it is satisfied with the working of the tramway system in the town.

Tottenham.—The plans submitted by the Metropolitan Electric Tramways, Ltd., showing the proposed widenings to be made to enable cars to run from the junction in the High Street, from Broad Lane to Ferry Road, have been approved.

TELEGRAPH and TELEPHONE NOTES.

Submarine Telephone Cable.—Negotiations are proceeding between the German authorities and the Royal Danish Telegraph Administration in respect of the construction of a direct telephone line between Berlin and Copenhagen by means of the laying of a new telephone cable between Fehmern and Laaland. In the event of this new connection being established, it could be rendered useful for communication between Germany and Sweden. It is already possible to telephone from Berlin to Malmo, Lund, Helsingborg, and a number of other localities in Sweden.

Telegraphic Interruptions and Repairs:—

	Interrupted.	Repaired.
Cables.		
Cayenne-Pinheiro	Aug. 13, 1902 ..	..
Curacao-Coro, Curacao-La Guayra, Curacao-Maracaibo	Closed.. Jan. 12, 1906 ..	..
Reissa-Issa and Reissa-Yemani (Yemen)	Oct. 22, 1902 ..	..
Tarifa-Tangier	Jan. 18, 1904 ..	..
Port Arthur-Chifu (Closed)	Mar. 9, 1904 ..	..
Garachico-Santa Cruz	July 12, 1906 ..	..
Las Palmas-Arecife	Aug. 18, 1906 ..	..
New Brunswick-Prince Edward Island	Jan. 9, 1907 ..	May 17.
Dakar-Conakry	April 24, 1907 ..	..
Landlines.		
Puerto-Barrios	Aug. 2, 1902 ..	..

Wireless Telegraphy.—According to the *Daily Mail*, a portable wireless telegraphic outfit devised by the Marconi Co. for land warfare is in use at the Military Tournament. The apparatus can be carried on mules, and has a range of 15 miles, while by means of two poles with a horizontal connecting wire at the top, Mr. Marconi's system of directing the waves and ascertaining the direction of a distant station, already described in our pages, can be utilised.

CONTRACTORS' COLUMN.

Openings for new Business.

ALSTON (Cumberland).—Secondary schools. C. C. Hodgson, secretary, Education Committee, The Courts, Carlisle.

BARNES.—Depôt (£4,650). G. Bruce Tomes, engineer and surveyor, Urban District Council.

BARRY.—General Accident and Surgical Hospital. J. C. Pardoe, surveyor, 160, Holton Road, Barry.

BOLTON.—Two new pavilions at Townley's Hospital, also medical officer's residence. S. Coope, architect, 24, Mawdsley Street, Bolton.

New spinning mill promoted by W. Tong, Mayor.

New works for Dobson & Barlow, textile machinists.

(Farnworth).—New secondary school to be built by the C.C. (£15,000).

BO'NESS.—Reconstruction of shop property for Co-operative Society (£3,000).

BRIDLINGTON.—Fog signal house for Trinity House at Flamborough Head. Corduroy, Selby & Corduroy, 21, Queen's Anne's Gate, London, S.W.

BRITON FERRY (Glam.).—New school. F. M. Franklen, clerk to the C.C., Westgate Street, Cardiff.

BROCKLEY.—Church (£70,00). F. H. Greenaway and J. E. Newberry, 21, Queen Anne's Gate, Westminster, architects.

BURY.—New children's holiday home. W. E. Gill, architect, Bury.

CARDIFF.—Railway refreshment room. Engineer, Gt. Western Station, Newport (Mon.).

CROSBY (Scunthorpe).—New public school. Scorer & Gamble, architects, Bank Street Chambers, Lincoln.

CWM (Mon.).—New police station. W. Tanner, F.S.I., County Surveyor, Newport (Mon.).

DENBEATH (Fife).—New school (accommodate 1,000). G. Charles Campbell, architect, East Wemyss.

DUNDEE.—Proposed restoration of city churches. McGregor Chalmers, architect, Glasgow.

ENFIELD.—Schools. G. E. Laurence, architect, 22, Buckingham Street, Adelphi, W.C.

HALIFAX (Stainland).—New mill for B. Taylor & Sons. C. F. L. Horsfall and Son, architects, Lord Street Chambers, Halifax.

HARROGATE (Pannal Ash).—Cottage homes. R. Oldham & T. J. Hill, architects, 55, Cross Street, Manchester.

HASTINGS.—Vicarage. F. Plowman, architect, 35, Havelock Road, Hastings.

HEMSWORTH.—189 houses for Hemsworth Collieries. Garside and Pennington, architects, Pontefract; Paul Rhodes, builder, Leeds.

HEREFORD.—Enlargement of the cathedral (£2,800). John Thompson & Co., builders, 43, Wood Street, Peterborough.

HUDDERSFIELD (Gledholt).—New Wesleyan Sunday Schools, &c. W. Cooper, architect, 4, Kirkgate Buildings, Huddersfield.

LITTLE HULTON (Bolton).—Enlargements to mechanical stoker works for E. Bennis & Co., Ltd.

LONDON, W.—Drapery, &c., premises for Selfridge & Waring on site of Nos. 406 to 422, Oxford Street.

(Finsbury).—Buildings on site of 78, 80 and 82, Whitecross Street, for Tubbs, Lewis & Co., elastic cord manufacturers, &c., 29 and 30, Noble Street, E.C.

(Notting Hill).—Institutional factory. Julius F. Gems, 14, Goodge Street, W., architect.

(St. Pancras).—Building for nurses. A. A. Millward, clerk to the Guardians, Pancras Road, N.W.

(Soho).—Hospital for women (£40,000). H. Percy Adams, architect, 28, Woburn Place, W.C.

(Westminster).—Rebuilding County Court, St. Martin's Lane. H.M. Office of Works, Storey's Gate, S.W.

LYTHAM.—New Fylde College, including assembly hall, master's house, art room and museum and laboratories. Briggs, Wolstenholme and Thornley, architects, 51, North John Street, Liverpool.

MANCHESTER.—New foundry at Patricroft. Mitchell & Shackleton, engineers.
Extensions to Crumpsall Workhouse (£21,000).
(STRETFORD).—Extensions to Victoria Park Schools. E. Woodhouse, architect, 88, Mosley Street, Manchester.
MERTHYR TYDFIL.—Extension of workhouse infirmary. T. Roderick, architect, Clifton Street, Aberdare.
MOLD.—New General Post Office to be built. F. A. Roberts, architect, Mold.
NEWPORT (MON.).—Higher Elementary School (£20,000) and Technical Institute (£20,000) to be built.
OLDHAM (HOLLINWOOD).—New cotton spinning mill to be built for Mr. George Fox. Plans being prepared by F. W. Dixon, architect.
PORTSMOUTH.—Technical Institute (switchboards and wiring for experimental purposes, electric light fittings, and special electric light fittings). Principal, Technical Institute, Arundel Street, Portsmouth.
RAMSGATE.—New hospital to be built. J. H. T. Woodd, architect, London.
REDDISH (STOCKPORT).—New cotton spinning mill for the Broadstone Spinning Co. Plans in preparation.
SHEFFIELD.—New General Post Office to be lit by electricity. Walter Potts, architect, Office of Works, London.
Public school at Darnall. Potter & Sandford, architects, 16, Great James' Row, Sheffield.
SLEAFORD.—New church (proposed) £5,000-£6,000. Rev. [A. Langdon (Rural Dean).
SOUTHEND.—Wesleyan Methodist church, York Road (£5,000).
SOUTH SHIELDS.—Infectious diseases hospital to be built by the T.C.
STOCKPORT.—New public school (£14,788). T. and W. Meadows, builders, George's Road, Stockport.
STOCKTON-ON-TEES.—New theatre to be erected by Mr. Humphrey, Sunderland.
STONE (STAFFS).—Isolation hospital to be erected by Joint Hospital Board (£7,500).
TWYFORD ABBEY (MIDDLESEX).—Factory for H. C. Cleaver & Co., 3, Eden Street, Hampstead Road, N.W.
WALTHAMSTOW.—Factory in Sylvan Road. J. W. Dunford, 100c, Queen Victoria Street, E.C., architect.
WALSALL.—Converting old library into School of Art. Bailey & McConnal, architects, Bridge Street, Walsall.
WIGAN (BILLINGE).—New workhouse infirmary (£31,566) to be electrically equipped. Heaton, Ralph & Heaton, architects; D. A. Ablett, builder, Wigan.
WIGAN.—Wesleyan mission hall (cost, £19,000). Bradshaw & Gass, architects, Bolton and London; J. Johnson & Son, builders, Wigan.

CONTRACTS OPEN and CLOSED.

OPEN.

Algiers.—June 1st. The Post and Telegraph authorities require tenders by June 1st, for supply of a multiple telephone commutator switchboard for the new G.P.O. Particulars from and tenders to Inspecteur-Général des Postes et des Telegraphes, 12, rue d'Uncont d'Urville, Algiers.

Bedford.—May 25th. Cables for 12 months. See "Official Notices" May 10th.

Belfast.—June 1st. Lighting switchboard and motor generator for the Corporation electricity station. See "Official Notices" May 17th.

Belgium.—The municipal authorities of Ougrée, near Liège, have just invited tenders for the concession for the public and private electric lighting of the town.

Dartford.—June 11th. Annual supplies (oils, meters, cut-outs, cable, stores, etc.) for the U.D.C. See "Official Notices" May 17th.

Derby.—Bitumen insulated cable. See "Official Notices" May 17th.

Ealing.—June 1st. One water-tube boiler for the electricity works. See "Official Notices" May 10th.

Heston and Isleworth.—June 3rd. Electricity meters for the U.D.C. See "Official Notices" to-day.

Ilford.—June 11th. Repair and maintenance of battery for the U.D.C. See "Official Notices" to-day.

L.C.C.—June 11th. Electrically-operated car traversers. See "Official Notices" to-day.

L.C.C.—June 11th. High and low-tension switchgear for five tramway sub-stations. See "Official Notices" April 26th.

Limerick.—June 11th. Stores for the Electricity Department. See "Official Notices" May 10th.

Nelson.—June 3rd. One Lancashire boiler with superheater and steam pipes. See "Official Notices" May 17th.

Partick.—June 3rd. Stores for the electrical department. See "Official Notices" to-day.

Queensland.—June 24th. Supply of Post and Telegraph Stores. See Note in this column May 17th issue.

Spain.—Tenders were recently invited by the municipal authorities of Mombelhán (province of Avilà) and Burriana (Castellon) for the concession for the electric lighting of the towns during periods of respectively 14 and 5 years. Not a single offer was, however, received.

Swansea.—June 4th. Arc lamps and pillars, resistances, choking coils, &c., for the electricity department. See "Official Notices" to-day.

Warrington.—June 5th. Low-tension cable for the Corporation. See "Official Notices" to-day.

Whitehaven.—May 28th. Condenser, auxiliary plant, piping, etc., for the Electricity Department. See "Official Notices" May 10th.

CLOSED.

Ayr.—The North-Western Electrical Appliance Co. has just received an order from the Corporation for complete sets of arc lamp gear, making the second repetition order from this Corporation, after trial with other types of gears.

Bristol.—The T.C. has accepted the tender of Siemens Bros.' Dynamo Works, Ltd., for the supply of a steam turbo-alternator (No. 6), at £800.

Govan.—The Corporation has accepted the tender of the Adams Manufacturing Co. for the supply of "Igranic" motor-starters to the electricity department during the ensuing year.

London.—WESTMINSTER.—The City Council has accepted the following tenders in connection with the Monck Street depôt:—

Alliance Electrical Co.—Re-wiring premises, £127 10s.
Waygood & Co.—Hoist and 4½-H.P. motor, £60.
Richmond & Chandler, Ltd.—Chaff-cutter and sifter and 5-H.P. motor, £62 12s.

STOKE NEWINGTON.—The B.C. has received the following tenders for the electric light wiring of the Town Hall:—

Appliances & General Engineering Co. ..		£238
Pinching & Walton		198
Strode & Co.		197
Chas. Pullan		195
A. V. Gifkins & Co.		179
G. Weston & Sons		179
Tilley Bros.		165
J. H. Golding		160
Miskin & Rice		159
B. Soloveitchik		140
A. R. Ashmore & Co.		120
W. J. Fryer & Co.	(accepted)	119

Lowestoft.—The T.C. has accepted the tenders of the Lahmeyer Electrical Co. for two feeder cables and pilot wires for the extension of the electric light to Kirkley, at £2,632, and for 2,300 yards of feeder cable and 2,300 yards of pilot cable, at £1,452; and that of the British Insulated & Helsby Cables, Ltd., for a feeder pillar, at £12 5s., and two disconnecting boxes, at £2 14s. each.

Poplar.—The B.C. has accepted the tender of Messrs. Clark, Chapman & Co., at £2,100, for a boiler complete with chimney and superheater for the electricity works (subject to the consent of the L.C.C. to the necessary loan). The boiler is of the Woodeson type. The other quotations were: Stirling Boiler Co., £2,440; Babcock and Wilcox, £2,660.

Sheffield.—Messrs. Thermit, Ltd., have received an order from the Corporation for one of their Mattinson's patent portable rail grinders.

Southport.—The T.C. has accepted the tender of Messrs. Allen & Co. for the supply of manganese steel for the tramways, at £1 17s. 4d. per cwt., and that of Messrs. Belliss & Morcom for a new governor for the engine at the electricity works.

Wolverhampton.—The Corporation has accepted the tender of Messrs. Willans & Robinson, Ltd., for two 1,000-KW. steam turbines, including surface condensing plant (to be built by Messrs. Willans & Robinson), and alternators, to be built by the Electric Construction Co. The figure given in this section last week for Messrs. Willans and Robinson's part of the contract was, of course, incorrect. The amount should have been stated as £13,416, not £1,214.

Woolwich.—The B.C. received the following tenders for an electric motor to work the economiser scrapers at the Plumstead Baths:—

Veritys, Ltd.	(accepted)	£31 10
Marples, Leach & Co.		40 14
Sun Electrical Co.		51 18

FORTHCOMING EVENTS.

To-day's Events.—Friday, May 24th.—At 9 p.m. Royal Institution of Great Britain. Discourse by Prof. J. A. Fleming on "Recent Contributions to Electric Wave Telegraphy."

At 7.30 p.m. North-East Coast Institution of Engineers and Shipbuilders. Paper "On Some Experiments on the Magnetic Character of Vessels," by Capt. W. Bartling, I.N.R.

At 5 p.m. Physical Society. Meeting at the Royal College of Science. Paper "On the Measurement of Mutual Inductance by the Aid of a Vibration Galvanometer," by Mr. A. Campbell; "Note on the Rate of Decay of the Active Deposit from Radium," by Messrs. W. Wilson and W. Makower; Exhibition of Apparatus for Relay Working of Long Submarine Telegraph Cables, by Mr. S. G. Brown.

Tuesday, May 28th.—At 7.30 p.m. Faraday Society. Annual general meeting; to be followed at 8.15 p.m. by an ordinary meeting. Papers:—"Contributions to the Chemistry of Gold," by F. H. Campbell; "Reduction of Oxides, Sulphides, &c., by Means of Metallic Calcium," by F. Mollwo Perkin, Ph.D.; Dr. T. M. Lowry will exhibit thermostatic apparatus.

Thursday, May 30th.—Royal Institution of Great Britain. Prof. Sir James Dewar on "Chemical Progress—Work of Berthelot, Mendeleeff and Moissan." (Lecture II.)

NOTES.

Electricity Works Statistical Tables.—Our annual Table of Electricity Works Statistics is now approaching completion, and will be ready for issue early next month. We shall be glad to receive as soon as possible all data forms which have not yet been returned, in order that the latest corrections may be included; after the last day of the current month it will be impossible to do this.

Electrical Plant in Italy.—During the past 10 years electrical applications have made great strides in Italy, and the *Elektrotechnik und Maschinenbau* gives the following account of the machinery equipments of the several establishments and the sources whence the plants have been drawn. Of the equipment of the hydro-electric generating stations, 80 per cent. of the turbines installed were supplied by Italian firms, and mainly from the Societá Riva Monneret y Ca.; of the balance, Swiss firms, and notably Escher, Wyss & Co., furnished the greatest number, while the German firm of Voigt and the Austrian firm of Ganz were minor contributories. The Francis was the most common turbine employed, and chiefly for low falls and large bodies of water (*e.g.*, Vizzola, 65 cubic metres per second, 28 metres fall; Turbigo, 18 cubic metres, 8 metres fall); but for moderate flows and falls of considerable height, Pelton wheels are used (*e.g.*, Caffaro, Villa d'Ossola; one metre per second and 250 metres fall) in units up to 3,000 H.P. Up to March, 1906, there were 205 hydraulic units installed with a total power of over 200,000 horse, and 73 of the plants exceeded 1,000 horse. Of steam plants, almost all were supplied by the firm of Franco Tosi, of Legnano; since 1896 there has been added to the 100 existing installations of a total of 60,000 H.P., 200 installations, aggregating 150,000 H.P., including some single sets of 3,000 H.P. The most recent machines are fitted with Lenz valve gears, and work generally at a speed of 125 R.P.M. The Parsons steam turbines employed are built, under the patents of Brown, Boveri & Co., by the firm of F. Tosi, and several of these installations have lately been put down in Italy. The total power of the steam turbines working is 45,000 H.P. The firm of Gadda and Co. are constructing a steam turbine on the system of Bellazzo, and plants aggregating 55,000 H.P. have been laid down. Of the dynamos, those of the continuous current type are little employed, and are found in some small installations where accumulators are used. They are also adopted for electrolysis and the exciting of alternators. They are mostly of foreign origin, as are also traction motors. Alternate current generators in units up to 3,000 KW. are mostly imported from abroad, and chiefly from Switzerland, but the Italian firm of Gadda, Brioschi Finzi y Ca. have furnished some equipments. Air-cooled transformers are used in Italy up to pressures of 30,000 volts. The total value of the electric machines of various types imported into Italy in 1905 is estimated at 9,000,000 fr. Italian works supplied electric machinery to the value of 8,000,000 fr. The electric motors installed in 1905 reached a total of 42,100 H.P., against 23,800 H.P. in 1898. The total power of the 12,000 motors now working is estimated at 130,000 H.P., exclusive of traction motors. The spinning industry is beginning to make use of a large number of small electric motors. Electric lighting has developed to such an extent, that in 1906 as many as 3,000,000 glow lamps were sold in Italy, the greater part having been made abroad.

Johannesburg Gas Plant: A Fatality.—An inquest was held at Johannesburg last month on the body of a native who was killed by gas at the electric power station. The Coroner in delivering his finding on the 22nd inst., said that the evidence disclosed a grave scandal. The conditions existing at present were such as to render not only health but lives in serious danger. Cases of gassing appeared to be on the increase, and employés carried their lives in their hands every day.

At the Town Council meeting held on April 25th, the tender of Messrs. Reunert and Lenz to supply two steam engines for the 'ectric power station was accepted, the price being £11,317, very within seven weeks.

Boiler Combine.—We learn on good authority that in future the Stirling boilers will be made at the Renfrew Works of Messrs. Babcock & Wilcox, and the Motherwell Works of the Stirling Co. will be closed.

Electric Pumping.—At the meeting of Harrison, Ainslie & Co. last week, Sir Owen Randal Slacke said that the directors had come to the conclusion that a large electrical installation with centrifugal pumps would be by far the most efficient means of unwatering the flooded mines. The estimated cost amounted to £50,000, and the most advantageous mode for providing this sum had to be decided upon, a syndicate comprising their own shareholders having agreed to find the money required upon terms satisfactory to the company. By agreement, the company had the option of leasing for 21 years the whole of this plant and appurtenances for a rental of £5,000 a year, merging into a royalty of 1s. per ton, or they could purchase it at an agreed figure of £50,000, the syndicate having the right of taking payment in cash or fully paid shares at their option. They had elected to be paid in shares if the shareholders decided to purchase the plant. The plant, which would be the largest of its kind ever erected, was being supplied by the Electrical Co., and would be capable of dealing with 16,000 gallons of water a minute, gradually decreasing to 8,000 per minute, at the maximum depth, which quantity was largely in excess of anything hitherto encountered, and allowed a margin of more than double what they were ever likely to require. During the summer months the inflow of water did not exceed 3,000 gallons a minute, which consequently would make the unwatering of the mines with the appliances at their disposal a very quick and easy task. Under all the circumstances, the directors strongly advised the purchase of this valuable electric plant, and they consequently supported the special resolution to increase the capital by the creation of 50,000 additional ordinary shares. This large electrical installation was not being established on the chance of finding ore, but in mines which were known to contain an almost inexhaustible supply of ore, for which there was an ever-ready sale at the highest market price. The cost of production would be greatly reduced when the new machinery was established. With the mines in full operation, an estimated production of 1,000 tons of ore per day would be small.

Electric Shock Fatalities.—Last month C. L. Johnson, an employé of Messrs. Dick, Kerr & Co., Ltd., while engaged at the Lang Park sub-station of the Sydney (N.S.W.) municipal electricity system, was killed by electric shock. He appears to have been engaged with others in removing some cables that had been used for testing purposes on the previous day. About half the work had been completed, when a cry was heard, and deceased was seen to fall. He had by some means come into contact with a "live" wire energised with the high-tension current at 5,000 volts. Every effort was made to restore animation, but without avail. Richard Woof stated that deceased was not a skilled man, and the wires he was removing were "dead." He had no right to be where he was when he touched the "live" wire. A Sydney correspondent informs us that the deceased entered the sub-station without authority. The wires were resting on the D.C. main, and he attempted to lift them off.

Roberts v. Reliance Lift and Engineering Co., Ltd.—On the 16th inst., judgment was given in this case (reported in the ELECTRICAL REVIEW, May 10th, page 758) at the Bradford County Court. The full claim amounted to £56 10s. for work done in connection with two electrical lifts at the Bradford Workhouse Infirmary, but of that sum £38 was admitted by the defendants, who brought a counterclaim of £73. His Honour, who heard the evidence a fortnight ago, now struck out two small items in the claim, and allowed £53, and gave judgment for £18 10s. on the counterclaim.

Technical Travellers for Abroad.—*South Africa* has recently been referring to the necessity for having technical travellers seeking British business abroad. It quotes a technical writer as follows:—"I am, indeed, fully convinced that what British trade in South Africa needs at the present time, in order to stem the tide of foreign competition which has within a few years reduced our share of the market from 75 to 55 per cent., is a closer personal touch with the actual requirements of the country." Our contemporary adds:—"In many respects the traveller sent out to represent British firms in South Africa is open to considerable criticism and objection. Too often he is a person of greater 'social' personality than business technicality. He is too apt to rely on the prestige of the firm he represents, particularly if, as is often the case, he is a member of the house who has been sent out as a compromise for a health trip free from business worries. What is wanted is a technical, practical man, who can not only sound the praises of the 'line' he carries, but meet local objections by practical demonstration. It is not uncommon to meet travellers pushing some form of machinery, with the details of which they have only the most casual acquaintance. At an agricultural display in Natal recently, the representative of a very effective machine, when called upon to explain some technical peculiarity, had to confess his ignorance. It is not suggested that such cases are frequent, but they are sufficiently numerous to create a bad impression. With so many capable and pushing Americans and Germans in the field, British firms cannot afford to give away any points. Prestige is doubtless a very effective weapon in old countries where the names of the firms are household words, but in South Africa names and records do not carry quite the same potency. The average farmer cares less who made the particular machine than whether he 'can work it and get out of it what he wants.' It should be the business of the traveller to prove this."

Institution and Lecture Notes.—Institution of Electrical Engineers (Manchester Students' Section).—At the last meeting of the Committee of this section, Mr. John Roberts, jun., was elected vice-chairman; and Mr. J. Lawton Lovell, hon. secretary, for the ensuing session. Mr. Roberts was the first secretary of the section, doing a large amount of valuable work incidental to its formation, and retiring only on his removal from Manchester, to which city he has now returned.

Physical Society.—At the meeting held May 10th, a paper on "Stereoscopy with long base-line illustrated on the screen," was read by Dr. T. C. Porter.

United Service Institution.—Under the the title of "Submarine Telegraphy" a lecture was recently delivered by Mr. Charles Bright, F.R.S.E., before the United Service Institution. The lecture was mainly historical, and presented no special features of novelty as regards information on the subject; indeed, elementary details such as are suitable to a general audience only were touched upon. As an historian of telegraphy, and especially of submarine telegraphy, Mr. Bright is undoubtedly an adept, and he has succeeded in collecting together a mass of subject matter which would otherwise have been lost to the world, albeit such matter is of no great scientific interest. Wonderful as is the progress which is being made at the present day, one cannot but be struck with the remarkable pluck and determination with which the early pioneers worked, and with the success they attained in spite of unexampled difficulties, and occasional references to such work in lectures of the kind delivered by Mr. Bright are of value. Beginning with signalling, the lecturer briefly described the apparatus employed; next he dealt with the construction of the cable, illustrating the subject with numerous lantern slides. Methods of laying cables, and repairing them, followed, and the lecture concluded with a sketch of the fascinating history of submarine telegraphy. As the pictorial element predominated, the matter being mainly descriptive of the lantern views, we are unable to abstract the lecture with advantage. It was repeated at Cambridge on April 30th.

Accident.—A motorman fainted while driving an electric tramcar at Southport on 21st inst. The conductor applied the brake from the rear end and stopped the car, but not before there had been a collision with a haycart, the driver of which was slightly hurt.

Appointments Vacant.—Station superintendent for Greenock (50s.); chief electrical engineer for city of Auckland, N.Z. (applications will require to be posted by mail leaving here on June 7th); switchboard attendant for Devonport (30s.).

Woolwich Arsenal Discharges.—According to the *Globe*, in the electrical branch of the Royal Laboratory at Woolwich Arsenal 130 men out of a total of 400 are to be discharged in small batches.

Electrical Undertakings in Japan.—The Japanese Empire is regarded in America as a good field for manufacturers of electrical devices. The *Journal of Electricity, Power and Gas* says that according to the list of Japanese enterprises formally organised and projected since July, 1905, furnished by Consul-General H. B. Miller, of Yokohama, the new capital of companies building electric railways amounts to £11,000,000, and the investment in other electrical enterprises is £10,000,000, of which between £5,000,000 and £6,000,000 is employed in developing Japanese water-powers. Only £3,000,000 has gone into steam railways. In all £50,000,000 fresh capital has been contributed to Japan's industrial expansion since the Treaty of Portsmouth.

German Electrical Trade in England.—The Berlin correspondent of the *Daily Telegraph* says: "The managing director of the Allgemeine Electrizitäts Gesellschaft informs me that there is no foundation for the report that his company is contemplating a wide extension of its business in Great Britain, including the formation of daughter concerns in some of the principal cities."

Electricity in the Laundry.—Saturday last saw the close of what proved a very interesting show at the Agricultural Hall, London—the Laundry Exhibition organised by Messrs. Cordingley & Co., under the auspices of the Laundry Engineers' and Allied Trades Association and the Launderers' Association. It is five years since a similar display was held, and it was evident that considerable progress had been made both in the design and construction of laundry machinery in the interim. A walk round the Show, too, proves that even in laundries, electricity is nowadays playing a not unimportant part, for among the exhibits were several appertaining to the electrical industry.

A very interesting plant known as an electrolyser was shown by Messrs. Ernest Grether & Co., of 5, Blackfriars Street, Manchester. It is designed for the production of an electrolytic washing liquid—sodium hypochlorite—which will give all the advantages of the chloride of lime solution usually employed to whiten linen, with none of its drawbacks. The complete plant comprises a wooden brine dissolving tank with an agitator, and the necessary valves and taps, the electrolyser proper, which is made of stoneware, a marble switchboard and a collecting tank. The brine dissolver is filled with a measured quantity of water sufficient for a day's use, to which is added a given weight of common salt, which is dissolved by a few turns of the agitator, so that the resultant brine shall be of a uniform strength. The tank is connected by a lead tank to the electrolyser so as to allow the brine slowly to flow into it; the electrolyser is connected up to a supply of electricity—the electric light mains in the case of electrically-lighted laundries. The current flowing through the apparatus decomposes the brine, producing electrolytic washing liquor, which flows into the collecting trough from which it may be drawn as required. The plant, as designed for laundries, works with a current of 12 amperes at 110 volts, although it can be adapted for any voltage; it supplies from 110 to 132 gallons of liquor of a strength of 210 grains per gallon per day of ten hours; for use 70 grains per gallon is the ordinary strength, so that the liquor has to be diluted with three times its bulk of water. The plant is stated to be in use in a number of establishments in Germany, and to be giving satisfactory results in practice.

Electrically-driven hydro-extractors were shown by two firms—Messrs. Watson, Laidlaw & Co., of Dundas Street (South) Glasgow, and Messrs. Thomas Broadbent & Sons, Ltd., Central Ironworks, Huddersfield. The Watson-Laidlaw machine is of the suspended type, the 36-in. cage being suspended from above. The motor is carried above the steel framework, and is not rigidly connected with the hydro, but drives through the medium of a friction coupling, which consists of a number of wooden blocks, which under the action of centrifugal gravity, fly out and grip a driving disc on the upper end of the machine spindle. This permits the motor to be switched directly on to the main without the use of a starting resistance, and also prevents it taking an excessive current at starting. The current is switched on and off by a lever, which is connected up to the brake provided for bringing the machine to a standstill, in such a way that the motor cannot be put in operation when the brake is on. The Broadbent machine is of the self-balancing pivot type, the electric motor being located below the hydro, and connected to the spindle through a friction drive.

The exhibit of the James Keith & Blackman Co., Ltd., of 27, Farringdon Avenue, E.C., included a range of electrically-driven Blackman fans and a "Keith" pressure blower, operated by an electric motor, for use in laundries in connection with shirt and collar ironing machines.

A big series of the "Wing" air ventilating fans, ranging from 14 in. to 9 ft. in diameter, was shown by Messrs. F. W. Potter & Co., of Phipp Street, E.C., as well as a range of the "Wing" electric motors, from $\frac{1}{8}$ to 10 H.P., starting switches with speed regulator, and "no load" and special "overload" release, dynamo brushes, &c.

Suction gas plants were shown by several firms, including Messrs. Capel & Co., of Dalston Lane, N.E., who ran a 25-H.P. gas engine, coupled up to a Johnson-Lundell laminated field dynamo, which was used for lighting their own and neighbouring stand by means of the special enclosed arc lamps of Messrs. Foster & Co., Wimbledon.

West African Rubber.—In his report on the trade, agriculture, &c., of French West Africa for the year 1905-6, which has lately been quoted in the *Morning Post*, Captain Comrie, his Majesty's Consul-General at Dakar, says that on the whole the quality of the rubber produced continues to improve, and prices have risen all round. The rubber, however, from the Ivory Coast and the Casamance District is still inferior to that from the other colonies, and somewhat strict measures are to be taken to improve it. In 1905 the export of rubber from French West Africa was about 300 tons below the average. In 1906 the deficiency was made good, and the total exports for the year were about 100 tons above the average. A special survey is being made of the chief rubber-producing districts, which will eventually be divided into three categories, as follow: (1) Unexploited districts; these consist only of a few regions in the Ivory Coast forests; (2) districts which are exploited, but have not been spoiled by excessive production and unscientific methods of collection; and (3) districts which have been spoiled for the above reasons: these latter are in the majority. When the survey and classification are complete, the Governor-General will, by decree, close the worst districts to rubber collection, so as to give the plants time to recuperate. A beginning will probably be made in 1908.

As regards plantations, the following general principle has been adopted: Indigenous rubber plants are considered to be the property of the natives, who alone profit by working them. In order, however, to prevent their exhaustion, the Government imposes on the natives who exploit the forests the duty of replanting. As a result of this policy 10,000,000 vines had been planted by natives up to the end of 1906. On the other hand, plantations of foreign rubber trees are made entirely by the State, and when ready for production will be exploited either directly by the Government or by private individuals under concession. Up to the end of 1906 the Government had planted 100,000 trees, consisting of heveas, castilloas, funtumia, and ceara. The plantations are made exclusively in Lower Guinea and Lower Dahomey. For 1907 a credit of £3,200 has been provided, with which it is expected that from 300,000 to 400,000 trees will be planted, besides nursery plantations for succeeding years. The intention is to set apart every year a credit of from £4,800 to £6,000 for this purpose, and to plant an average of 500,000 trees every year.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The fourth annual smoking concert of the Durban Corporation electrical department was held on April 20th. Mr. J. Roberts, the borough electrical engineer, presided, and among others present were the Mayor, the chairman of Lighting Committee, the town clerk, the town treasurer, &c., and a large number of members of the electrical department. The

arrangements for the evening were in the hands of a committee consisting of Messrs. Roberts, Harding, Hawkesworth and Clunas, with Mr. E. Poole as secretary. The musical programme was a very enjoyable one, and as a consequence the toast list was a short one. The Mayor, in proposing the toast of "The Department," referred to the revenue earned, which in the first year was £5,000, while this year a revenue of £76,000 is estimated. Mr. Hollander, chairman of Electric Light Committee, suitably responded. The next toast was that of the "Assistant Borough Electrical Engineer," Mr. A. Taylor, which was proposed by the borough electrical engineer, who also presented Mr. Taylor with a silver cigar case and gold sovereign purse, subscribed by the members of the department as a token of esteem on his leaving the colony for a six months' holiday in England. Mr. Taylor, who had a hearty reception, briefly responded, and the National Anthem brought the evening to a close.

The Bristol T.C. has appointed Mr. W. B. Morgan, mains superintendent, to succeed Mr. J. H. Bolam as station superintendent at a salary of £225 per annum, rising to £250 on December 1st next, and Mr. A. E. Wilson, assistant mains superintendent, as mains superintendent, at £175 per annum.

Mr. G. E. Swift, mains superintendent of the corporation electricity department at Plymouth, is recommended for the appointment of mains superintendent under the Chester Electricity Department. There were 135 applicants.

Woolwich Borough Council has received the resignations of Mr. S. P. Ives and Mr. T. W. Ellis, installation foreman, and canvasser and commercial assistant respectively in the electricity department. As the wiring department has been closed, it is not proposed to fill the vacancies.

General.—The managers and staff of Messrs. Kelvin and Jas. White, Ltd., Glasgow, have presented a silver cigarette case, gold sleeve links, and an umbrella to Mr. Thomas Wallwork, who is leaving to join the staff of the Blackburn Corporation Electricity Department.

The members of the staff of the Yorkshire Electric Power Co. held their first annual dinner and smoking concert on the evening of 16th inst. at Dewsbury, Mr. W. B. Woodhouse presiding. Mr. Woodhouse proposed "The Company," and Mr. J. J. H. Stansfield humorously responded. The evening's entertainment was provided by several members of the staff and their friends.

Our New York namesake reports that Mr. Bion J. Arnold, the well-known transportation expert and past-president of the American Institute of Electrical Engineers, has met with a most peculiar and painful accident in Chicago. He was trying a new automobile with his brother, and got down to crank the engine. The starting bar was too far forward, and when the engine kicked, Mr. Arnold's chin was forced down on the radiator and his teeth were driven through his tongue. The injured tongue was sewn together, and Mr. Arnold is doing well and hopes to be able to talk again soon.

Mr. J. Erskine-Murray, D.Sc., M.I.E.E., has removed to Oswaldestre House, Norfolk Street, Strand, W.C.

Obituary.—Sir Benjamin Baker.—The entire engineering world will regret the unexpected death on Sunday last of Sir Benjamin Baker, K.C.B. While the Forth Bridge and the Assuan Dam rank among the more colossal undertakings which have made him renowned, he had a very important part to play in connection with railway tunnelling operations—the electric tube lines of London, made possible by the invention of the Greathead shield, were pioneering undertakings which pointed out the way for engineers in other countries. The City and South London, and the Central London, were both laid with his assistance. Sir Benjamin, whose death occurred at his residence at Pangbourne, was president of the Institution of Civil Engineers in 1895. He was 66 years of age.

We regret to record the sudden death of Mr. Ronald Gordon Grant, a member of the staff of the Cleveland and Durham Electric Power, Ltd, which occurred on Sunday, 19th inst. The funeral was to take place on Wednesday from the residence of his brother-in-law, Mr. P. C. Pope, of Hale, Cheshire.

NEW COMPANIES REGISTERED.

Bickerton's Engine Syndicate, Ltd. (93,396).—This company was registered on May 16th, with a capital of £10,000 in £1 shares, to adopt an agreement with H. L. Bickerton and A. Firth, and to carry on the business of mechanical engineers, electricians, gas, oil and electric engine and motor manufacturers and dealers, garage proprietors, machinists, fitters, millwrights, founders, &c. The subscribers (with one share each) are:—A. Firth, 52, Hans Mansions, S.W., solicitor; W. G. Heatlie, 7, Rockhall Road, Cricklewood, accountant; A. Hayes, Bechel Lodge, Church Road, Southend-on-Sea; A. E. Rigden, 43, Sinclair Road, Kensington, W., secretary; C. Cutting, 117, St. James' Road, Holloway, N., clerk; A. C. Young, Ceylon House, Tonbridge, merchant; W. R. Gaff, 54, New Broad Street, E.C., chartered accountant. No initial public issue. The number of directors is not to be less than two or more than five; the first are to be appointed by the subscribers; qualification £250. Registered office, 54, New Broad Street, E.C.

Cable Accessories Co., Ltd. (93,345).—This company was registered on May 13th, with a capital of £7,000 in £1 shares, to acquire the business of an electrical and mechanical engineer carried on at Britannia Street Works, Tividale, Staffordshire, as the "Cable Accessories Co.," and to carry on the same and the business of electricians, manufacturers of and dealers in cables, wires, lines, accumulators and lamps, &c. The first subscribers (each with one share) are:—G. C. Hurrell, 155, Tividale Road, Tipton, Staffordshire, electrical engineer; E. Vaughan, Burnt Tree House, Burnt Tree, Tipton, ironfounder; Arnold Vaughan, 11, Charleville Road, Handsworth, Staffordshire, edge tool manufacturer; Alfred Vaughan, 6, Rotton Park Road, Edgbaston, Warwickshire, edge tool manufacturer; Mrs. L. M. G. Vaughan, 11, Charleville Road, Handsworth, Staffordshire; H. R. Vaughan, Burnt Tree House, Burnt Tree, Tipton, ironfounder; and F. H. Pepper, 34, Waterloo Street, Birmingham, solicitor. No initial public issue. Registered without articles of association. Registered office: Britannia Street Works, Tividale, Tipton, Staffordshire.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Urban Electric Supply Co., Ltd. (57,986).—An acknowledgment of indebtedness under seal, dated April 27th, 1907, securing a further £75,000 first mortgage debenture stock (supplemental to trust deeds dated July 28th, 1904, and December 17th, 1906, securing £200,000 first mortgage debenture stock) has been registered. Property charged:—Electric lighting and tramway undertakings, including lands, buildings, material, rolling stock and plant; certain freehold and leasehold hereditaments, shares and purchase moneys and the company's undertaking and property, present and future, including uncalled capital. Trustees: Merchants' Trust, Ltd., 63, Cornhill, E.C.

Warren, Beattie & Co., Ltd. (electrical engineers, Middlesbrough), (70,585).—A debenture, dated May 7th, 1907, to secure £1,500, charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Holder: H. Drummond, 6, Sackville Place, Newcastle-on-Tyne.

Madeira Electric Lighting Co., Ltd. (46,371).—This company's annual return was filed on March 26th, when the entire capital of £20,000 in £1 shares had been taken up; £1 per share has been called up on 14,000, resulting in the receipt of £14,025, including £25 on 100 forfeited shares; 6,000 shares are considered as fully paid. Mortgages and charges: £15,000.

Hudson & Bowring, Ltd. (75,213).—This company's annual return was filed on April 15th, when 3,142 shares had been taken up out of a nominal capital of £3,300 in £1 shares; £987 has been received, and £2,155 is considered as paid. Mortgages and charges: Nil.

CITY NOTES.

North of Scotland Electric Light and Power Co., Ltd.

The director's report for the year ending December 31st, 1906, gives the following table showing the progress made in its towns during the past two years:—

	1904	1905	1906
Montrose ...	15,130	17,542	18,740
Brechin ...	12,081	15,019	15,917
Inverness ...	—	5,322	7,617
Totals ...	27,211	37,883	42,274

The result of the year's trading, including a balance brought forward of £69 from the previous year, shows a gross profit of £1,922, and after allowing £1,654 for interest on debentures and outstanding loans, and writing £116 off the suspense account, there remains a balance of £152, out of which the directors propose to put £50 to reserve for bad and doubtful debts, and to carry the balance of £102 forward. £1,270 of debenture stock has been allotted during the year. Mr. F. E. Gripper retires by rotation, and offers himself for re-election as a director.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The half-yearly meeting was held on Wednesday last week at Electra House.

Sir John Wolfe Barry, in proposing the adoption of the report (see Electrical Review, May 10th, page 777), said that the gross revenue for the half-year showed a decrease of £21,000, which was mainly due to the abnormal traffic created by the Russo-Japanese war having ceased to exist. The traffics which were not affected by the war continued to show a steady improvement, and he was happy to say they were still holding their own in the keen competition which was being carried on between the Government Pacific Cable and their system for the Australasian traffic. The working and other expenses showed an increase of £4,000. This was accounted for by the supplemental allowances which it was found necessary to make to the staff to meet the rise in exchange in the value of the dollar in the Straits Settlements and China, and the exchange differences affecting expenditure due to the same cause. But for this special expenditure, the working expenses would have shown a decrease of, roundly, £4,000, in consequence of the cost of repairs to cables having been exceptionally light during the half-year. The net profit amounted to £138,383, and after adding £88,958 brought forward, there remained an available balance of £227,000. The usual quarterly interim dividends of 2s. 6d. per share were paid during the year, and it was now proposed to distribute a final dividend for the year of like amount, making a total dividend of 5 per cent. In addition, a bonus of 4s. per share would be paid, making a total distribution of 7 per cent. for 1906. The usual additions had been made during the year to the maintenance ships', insurance and depreciation funds, and, after adding £75,000 of the revenue balance to the general reserve fund, the sum of £17,344 was carried forward. During the past year their two New Zealand cables, the Hongkong-

Foochow and Foochow-Shanghai cables, as well as the Saigon-Singapore cable had been partially renewed. The lengths of new cable inserted in these lines aggregated 464 nautical miles, and the cost of the renewals, amounting to £44,160, had been debited to the general reserve fund. With a view to further improving telegraphic communication with the Far East, they had obtained a concession from the Dutch Government for the laying and working of a submarine cable between Java and the Cocos Islands. The length of cable involved was about 820 nautical miles, and was estimated to cost about £800,000. A portion of the cable would be supplied from their stock at Singapore, and the remainder manufactured and sent out from this side. The new communication was expected to be opened towards the end of the current year, and would provide a useful alternative route for their Far East traffic.

The Marquis of TWEEDDALE seconded the motion, and the report was adopted.

West African Telegraph Co., Ltd.

THE Marquess of Tweeddale (chairman) presided on Thursday, May 15th, at Electra House over the meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, May 10th, page 777), the CHAIRMAN said the gross income showed an increase of £312. This company's proportion of the receipts from the South African joint purse showed a reduction of about £1,500 as compared with the preceding year. There was also a slight diminution as compared with 1905 in the sum received on account of the diversion of traffic over their lines, owing to the interruption of the cables of other telegraph companies. On the other hand, the Portuguese traffic showed a small increase, and the amount received for interest on reserve fund investments was nearly £1,000 more than in the previous year. Further, in consequence of the continued improvement in the value of the Portuguese currency, there had been a profit on exchange of £965, as compared with a loss in 1905 of £1,308, the revenue account thus benefiting by this item alone to the extent of £2,273. The ordinary expenses amounted to £15,500, against £15,700, or a decrease of £200. The expenditure in connection with the maintenance of their cables showed a very satisfactory reduction of £4,000 as compared with 1905, the result being that their total expenses for 1906 were £4,200 less than they were in the previous year. He was glad to state that they had now come to a satisfactory arrangement with the income-tax authorities regarding the vexed question of the amount of depreciation on their cables, to be allowed when assessing the company for income-tax. Under it they had obtained a refund of £739, and as this was in respect of back years, the amount had been placed to the credit of the general reserve fund. Owing to its defective condition, it was proposed to renew in the autumn, a not inconsiderable portion of their Sao Thome-Loanda section. This renewal would involve a large expenditure, and demonstrated, if demonstration were necessary, the necessity for the policy which the directors had always followed of strengthening the company by placing substantial sums to the reserve fund. After putting aside £30,000 to the reserve fund, and allowing for the interim dividend of 2 per cent. paid in December, the directors were able to recommend the payment of a final dividend of 2 per cent., making 4 per cent. for the year, and leaving £2,155 to be carried forward.

Sir J. DENISON PENDER seconded the motion, which was carried without discussion.

Sir H. C. Mance was re-elected a director.

Western Telegraph Co., Ltd.

SIR JOHN WOLFE BARRY, K.C.B., presided on Wednesday last week at Electra House, E.C., over the general meeting of this company, and in moving the adoption of the report, he said they submitted a very satisfactory report and balance sheet, although a large proportion of the increased message traffic was due to an exceptionally regrettable cause—the lamentable earthquake at Valparaiso which caused the disruption of a competing route, resulting in the whole of the traffic being transferred to their cables. Apart from that special circumstance there was greater commercial activity in the South American countries served by the company, and the traffic from Brazil and the River Plate showed a small but steady progress.

There was one special item of expenditure, viz., the expenses in connection with negotiations. This represented the company's proportion of the expenses and payments connected with the concession recently granted for the new cables from England to the Azores and St. Vincent. They considered it better to debit this against revenue than to spread it over a period. The expenses attending the maintenance of cables was £40,928, showing a balance of decrease of £11,287. The expenses in connection with the cable steamer *Norseman* were more, in consequence of the cost of her survey and subsequent repairs, by £1,743, but on the other hand there was a decrease in her ordinary working expenses, and the result was that the ship cost £993 more than in the corresponding half-year. The steamship *Norse* was laid up for the whole of the period under review, and consequently the cost of insurance, etc., was borne by the company in place of the charterers, as was the case in 1905, and this accounted for an increase of £911. They were trying to dispose of this ship. The old *Cormorant* was only in commission for four months, and her expenses were less by £1,000, while the expenses of *Cormorant II.* were £3,400 which did not appear in the corresponding half year's accounts. The expenses of the storeship *Norma* were slightly increased, but chartered steamers cost £8,080 less. There were 113 knots less cable expended in repairs, which caused a saving of £12,229. The result of these savings and increases was a saving to the company of £11,287. Sundry expenses at stations in connection with repairs were more by £475. Their store of cable was larger than in the corresponding half-year, and consequently insurance to the amount written off for depreciation was more by £510. The amount received for the charter of the company's cable steamer was less by £4,090, as the cable ship *Norse* was hired by the Eastern Telegraph Co. for 172 days in the latter half of 1905. Although £100,000 had been transferred to reserve, the proprietors would observe that this fund had been depleted during the half-year by £74,315, being the balance of the cost of the new St. Vincent-Fayal cable, so that the fund had only been increased by less than £26,000. Further while their reserves nominally amounted to something over a million and a quarter pounds, yet it was not entirely represented by liquid assets. Capital account had been overspent by £18,000, the store of cable in hand was nearly £60,000, and the investments at present market prices showed a depreciation of something between £70,000 and £80,000. Part of their reserves also were of necessity employed as working capital. The shareholders had consistently endorsed the policy of the Board in building up substantial reserves, which they held to be absolutely imperative. In their system there were at least 4,000 knots of submarine cable which had been submerged for over 30 years, and almost the whole was in deep water; and another factor constantly before the Board was that their prosperous condition had apparently incited envy, so that further competition was threatened from several quarters. Under those circumstances they felt certain of the continued support of the shareholders in fortifying their general reserve fund.

SIR J. DENISON PENDER seconded the motion.

Replying to some remarks by Mr. Ellis, the Chairman said he did not wish to suggest that the expenditure upon the St. Vincent-Fayal cable was not a good investment. He thought it a very fine investment indeed, but shareholders would realise that had they not had the reserve fund they would have had to raise fresh capital in order to lay that cable, which was necessary for the system. He saw no immediate prospect of an increase in dividend. He always felt that in such an undertaking it was better to keep the dividend at a normal figure so long as they did not get too rich, and they were not likely to be in that position for some time to come.

South Staffordshire Tramways (Lessee) Co., Ltd.

THE report for 1906 states that the total revenue was £43,742, against £39,209, and the expenditure (including rental of lines and other payments to local authorities, repairs and maintenance of track, and interest on loans and upon debenture stock) amounted to £41,209, compared with £41,434. There was a profit of £2,532, from which had to be deducted the sum of £921, being the loss incurred during 1905, leaving a balance of £1,612, of which the directors recommend £1,000 be added to depreciation and reserve fund, carrying forward £612. The expenditure on capital account amounted to £33,900, of which £23,450 has been provided by the Birmingham and Midland Tramways, Ltd., on loan security, and £9,000 has been advanced by the South Staffordshire Tramways Co. The expenditure has been in respect of the reconstruction of steam tramways and old electric tramways, and the purchase from the Wednesbury Corporation of the King's Hill depôt for £11,500. The improvement in the traffic receipts has, to a large extent, resulted from the complete year's working of the reconstructed tramway between the Bull Stake, Darlaston, and the White Horse, Wednesbury. This line was only in operation by electric traction for three months in the preceding year. A further improvement in the gross traffic receipts may be anticipated from the electrification of other steam routes in Tipton and Dudley, and a reduction in the cost of permanent way repairs and repairs to rolling stock should take place as a result of the reconstruction of the old sections of electric tramways. The number of passengers carried was 8,625,743, against 7,782,261; and the average receipt per passenger 1·20d., against 1·20d.; average expenditure per passenger (apart from line rentals, &c.) ·73d., against ·85d.; proportion of expenses to receipts 61 per cent., against 71 per cent.

The meeting was held yesterday at Donington House.

Belgium.—La Société A.E.G. Union Electrique, of Brussels, reports a net profit of £10,644 for the last financial year. Work to the extent of £109,575 is at present in hand, an increase of £49,030, as compared with a year ago.

Antwerp Telephone and Electrical Works (Soc. Anon.).—We regret to find that an error occurred in the reference in our issue of May 10th, p. 777, to this company's balance-sheet. We understand the loss for the year was 68,578·98 fr., or £2,743, not £34,114, as stated by us.

Stock Exchange Notices. — The Committee have appointed Wednesday, May 29th, as special settling day in—

Liberian Rubber Corporation, Ltd.—150,000 vendors' shares of £1 each, fully paid, Nos. 120,001 to 270,000.

And ordered the undermentioned securities to be quoted in the Official List:—

Mackay Companies.—413,804 common shares of $100 each; and 500,000 preferred shares of $100 each.

Ross Electric Light Co.—At the meeting of this company it was decided to pay a dividend of 4 per cent. on the preference shares. The report was regarded as very satisfactory for the first year's working.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	May 15	2,688	— 30	50	68,668	+ 1,726	14·4	..
Ayr	,, 11	463	+ 30	£2	14,549	— 55	8	..
Bath	,, 15	1,629	+ 79	20	13,833	+ 17	13	..
Belfast	,, 17	7317	+ 961	7	24,325	+ 1,322	40	..
Birkenhead	,, 19	2,058	+ 72	7	7,060	— 337	13·52	..
Birmingham Corp.	,, 11	12,133	..	6	34,175	..	56·45	..
Blackburn	,, 15	2,149	+ 152	7½	8,274	+ 653	14½	..
Blackpool Corp.	,, 16	1,043	+ 14	..	4,209	— 849	11·67	..
,, —Fleetw'd.	,, 18	662	— 8	19	5,883	+ 304	8·25	..
Bolton	,, 20	4,892	+ 424	7	14,961	+ 107	26	..
Bournemouth	,, 15	3,186	+ 186	6⅔	10,767	+ 52	21·5	2·75
Bradford	,, 11	9,035	+ 470	6	27,158	+ 379	53	..
Brighton	,, 19	1,789	+ 44	7	5,953	..	9·5	..
Bristol	,, 17	10,095	+ 64	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	,, 10	439	+ 6	18	4,024	— 1	3·65	..
Barnsley	,, 10	323	+ 10	,,	2,894	— 60	..	..
Barrow	,, 10	465	+ 22	,,	4,042	+ 9	5·37	..
Cavehill	,, 10	134	+ 22	17	1,280	+ 47	..	..
Devonport	,, 10	868	+ 32	,,	7,979	+ 140	8·85	..
Gateshead	,, 10	1,997	+ 163	,,	17,852	+ 650	11·25	..
Gravesend	,, 10	454	+ 17	,,	4,040	+ 121	6·5	..
Greenock	,, 10	1,322	+ 76	,,	11,284	+ 139	7·25	..
Hartlepool	,, 10	518	— 4	,,	4,625	— 256	6·72	..
Kidderminster	,, 10	202	+ 16	,,	1,762	— 57	..	..
Leamington	,, 10	272	— 5	,,	2,533	— 121	3	..
Merthyr	,, 10	411	+ 26	,,	3,680	+ 217	2·9	..
‡Metropolitan	,, 10	8,745	+2,355	,,	73,694	+16,937	22	..
Middleton	,, 10	652	+ 59	,,	5,837	+ 118	8·5	..
Mid. Joint Com'tee	,, 10	11,185	+ 376	,,	100,312	+ 1,312	..	..
Oldham — Ashton	,, 10	1,172	+ 97	,,	10,626	+ 708	9·13	..
Peterborough	,, 10	234	+ 15	,,	2,022	+ 25	5·31	..
Potteries	,, 10	3,764	+ 205	,,	33,355	+ 461	29	..
Rothesay	,, 10	180	— 47	,,	1,563	— 7	2·75	..
Southport	,, 10	494	— 34	,,	4,345	— 250	8·17	..
S. Metropolitan	,, 10	1,409	..	,,	12,773	..	..	..
Swansea	,, 10	1,680	+ 78	,,	14,645	+ 407	5·5	..
Tynemouth	,, 10	345	— 35	,,	3,067	— 364	3·75	..
Weston-s-Mare	,, 8	123	— 26	,,	837	— 54	3	..
‡Worcester	,, 10	534	+ 15	,,	4,515	— 86	5·75	..
Wrexham	,, 10	187	..	,,	1,755	— 24	..	..
Yorks. Wool. Dist.	,, 10	1,905	+ 186	,,	16,851	+ 1,127	17	..
Miscellaneous	,, 10	446	+ 2	,,	3,688	— 69	..	..
Burnley	,, 18	2,514	+ 251	..	..	..	7·5	..
Burton-on-Trent	,, 19	566	+ 18	7	1,928	— 148	10	1·5
Bury	,, 12	1,184	..	6	5,791	..	10·5	..
Cardiff	,, 11	3,916	+ 117	6	11,910	+ 24	15·87	..
Carlisle	,, 18	358	+ 14	20	3,059	— 228	..	..
Chatham and Dist.	,, 18	1,440	+ 132	20	12,488	+ 979	12·84	3·51
Cork	,, 16	969	— 44	20	8,282	— 186	9·39	..
Croydon	,, 17	2,920	— 32	7	9,477	— 565	12	·75
Darlington	,, 18	438	+ 14	7	1,455	+ 13	..	..
Darwen	,, 10	519	+ 40	6	1,403	— 84	4·36	..
Dover	,, 18	431	— 9	7	1,477	— 123	4·75	..
Dublin	,, 17	11,610	+1,437	20	96,671	+ 4,262	54·25	5·75
Dundee	,, 15	2,224	+ 187	50	56,920	+ 7,483	13	·5
East Ham	,, 18	1,875	+ 70	7	6,218	— 153	8	..
Exeter	,, 17	594	+ 78	7	2,078	+ 195	4·75	·5
Glasgow	,, 18	35,655	+3,460	50	854,673	+69,297	84·25	4·75
Hastings	,, 16	1,958	..	..	..	..	..	..
†Huddersfield	,, 11	1,585	+ 106	6	9,535	+ 527	28	..
Hull	,, 18	4,812	+ 566	7	16,223	+ 902	13	..
†Ilford	,, 11	500	+ 37	6	2,884	— 117	6·37	..
Ilkeston	,, 15	288	+ 33	7	967	+ 121	3·5	..
Ipswich	,, 13	780	+ 27	7	2,592	— 120	10·5	..
Isle of Thanet	,, 18	882	+ 88	20	6,143	+ 99	11	..
Kilmarnock	,, 18	352	+ 5	52	8,229	+ 135	4·25	..
Lan'kshire Trm. Co.	,, 16	2,474	+ 693	20	21,102	+ 4,341	15·82	3·26
Lancashire United	,, 15	2,462	+ 713	20	22,413	+ 6,151	88·5	10·5
†Leeds	,, 11	6,560	+ 554	6	37,949	+ 2,648	96	6·5
Leicester	,, 18	4,763	+ 282	..	..	..	..	..
Leith	,, 11	1,005	+ 61	52	26,186	+ 6,369	6	..
Liverpool	,, 11	21,815	+ 895	19	198,033	+ 3,179	104	..
‡L.C.C.	,, 4	58,295	+8,930	5	144,741	+15,311	113·5	15·5
London United	,, 17	13,745	+1,280	20	110,716	+ 3,924	..	..
Lowestoft	,, 18	317	+ 75	33	5,041	+ 684	3·5	..
Manchester	,, 18	29,585	+3,613	7	97,681	+ 9,055	159	13
Newcastle	,, 18	8,172	+ 583	7	25,151	+ 753	..	..
†Newport	,, 18	630	+ 55	7	4,490	+ 253	14·5	..
Northampton	,, 18	872	+ 41	6½	2,852	— 22	5·5	..
Oldham	,, 19	3 824	+ 402	8	15,474	+ 1,605	23·75	..
Pontypridd	,, 18	491	+ 180	7	1,857	+ 642	5	1·75
Portsmouth	,, 18	3,627	+ 104	7	12,760	— 120	14·5	..
Preston	,, 15	1,443	+ 40	..	..	..	..	..
Reading	,, 16	1,231	+ 44	7	3,995	— 42	13·25	..
Rochdale	Feb. 19	958	+ 152	..	..	..	20·6	..
Rotherham	May 16	1,154	+ 221	6½	3,789	+ 563	10	·67
Salford	,, 13	9.076	+ 513	6	27,631	+ 323	38·9	..
Sheffield	,, 19	11,151	+1,030	8	43,885	+ 2,649	35·75	..
Southampton	,, 15	1,903	+ 96	6¾	6,058	+ 140	..	..
Southend-on-Sea	,, 15	671	+ 19	7	2,088	— 115	..	..
Sunderland	,, 5	2,664	+ 246	5	6,675	— 78	..	..
†Swindon	,, 8	158	— 15	..	..	..	4·4	..
Tyneside	,, 15	883	+ 90	20	8,079	+ 700	8·87	..
Wallasey	,, 18	1,569	+ 117	7	5,443	+ 185	8·55	·05
Walthamstow	,, 18	1,241	+ 87	7	3,872	— 112	9	..
West Ham	,, 16	4,812	+ 398	7	16,648	+ 929	14·7	..
Wolverhampton	,, 15	1,682	+ 89	6	5,41C	+ 111	20	..
Yorks. W. Riding	,, 19	2,420	+ 900	20	21.670	..	..	..
Baker St.-Waterloo	,, 18	4,750	+2,050	10	23,335	+ 8,746	4	·75
Cen. London Rly.	,, 18	11,752	—1,444	20	123,992	—12,725	6	..
City & S. Lon. Rly.	,, 19	5,850	+ 659	20	58,997	+ 1,516	7·5	1·25
Dublin-Lucan Rly.	,, 17	217	+ 5	20	1,953	— 11	7	..
G.N. and City Rly.	,, 18	3,521	+ 80	20	36,656	+ 133	3·5	..
G.N., P'dy. & Brmp.	,, 18	8,130	— 125	20	76,719	..	9	..
L'pool Overh'd Rly.	,, 19	2,984	+ 182	20	28,232	+ 342	6·8	..
Mersey Railway	,, 18	3,646	+ 289	20	36,598	+ 1,706	4·5	..
Metropolitan Rly.	,, 19	30,299	— 220	20	301,711	—25,452	24·5	..
Met. District Rly.	,, 19	15,562	— 626	20	156,555	— 3,198	24	..
Anglo-Argentine	,, 20	34,966	+3,564	20	330,591	+28,907	48	..
§Auckland	Mar. 29	9,846	+1,852	13	32,152	+ 860	19·24	·6
§Brisbane	,,	13,199	+1,688	..	..	..	..	..
§Brit. Columbia Rly.	Mar.	24,800	+6,630	39	224,000	+42,500	..	..
Bu'n's A'r's E.T.Co.	Mar. 2	3,247	+ 290	9	14,647	+ 1,859	..	..
†Bu'n's A'r's-Blgr'no	Apr. 21	3,911	+ 314	16	60,228	+ 4,091	..	..
Calcutta	May 18	5,989	+ 375	..	..	..	..	..
§Geneva	Apr.	7,256	+ 306	..	..	..	..	..
§Kalgoorlie, W.A.	,,	3 895	..	17	15,608	..	20·5	..
Madras	May 15	1,172	+ 291	19	10,365	+ 1,674	12·75	3·5
§Lisbon	Mar.	28,000	..	..	..	..	..	..
Perth (W.A.)	May 17	2,743	— 230	20	29,590	— 620	26·48	·32

* Compared with the corresponding period of 1906.
‡ Includes horse, steam and other receipts.
† One week only.
One month.

STOCKS AND SHARES.

Tuesday Evening.

Markets have hardly got over the effects of the Whitsuntide recess, up to this Tuesday evening, and there is not much to say about electrical descriptions. The acute flatness in Home Railway stocks has been stayed, prices showing a tendency to mend on the slight demand from investment quarters. The forbidding weather during the holiday, probably exercised a bad effect upon traffics, but, if anything, this ought to have told in favour of the tube railways.

Prices of electrical railway stocks are quietly steady at their low levels. The Central London trio is without change, and City and South London remains at 42. After being better, Metropolitan Consolidated relapsed to 42½, and Districts fell to 13½.

To diverge for a paragraph, some surprise was expressed in Stock Exchange circles that the will of the late Mr. C. T. Yerkes, of Underground Railway fame, showed Illinois property amounting to no more than the equivalent of £640,000 sterling, and an additional £5,600 gross in the United Kingdom. Substantial as the former amount is, Mr. Yerkes in his lifetime was commonly accounted a millionaire.

Electricity Supply shares are all but motionless. Brompton and Kensingtons continue to attract a few purchasers. The cheap Edmundson's Preference, mentioned here last week, were taken, but fresh lots of shares came into the market, and the price, after being 2¼ bid, fell to 2. The market appears to think that the slump in these Preference shares has been overdone, and that the fall to 40s. discounts a good deal. Shareholders, however, should press for an immediate—and a full—statement of affairs, that they may judge for themselves how the company stands. Urban Preference have been put down to 3; they carry 5 per cent. interest against the 6 per cent. of the Edmundson's Corporation. Metropolitans weakened to 6¼.

St. James' 3½ per cent. Debenture stock fell 2 points, and business was done at 88. Metropolitan Electric 4½ per cent. First Debenture came down a point to 107. Dealings in the Debenture issues are few and far between, and a good proportion of the quoted prices are little more than nominal. It is impossible to give an actual figure for stock in which there has been no public business, perhaps, for a couple of months.

An obviously-inspired article in a financial paper about British Electric Tractions has not helped the prices. The market is doubtful as to the value of this sort of adventitious aid in times like the present, when people have really attractive investments offered them at low prices. British Thomson-Houston Debenture is dull again.

More business in Anglo-Argentine Trams has resulted in the Ordinary rising $\frac{3}{16}$ to 7¾, although the Preference were slightly easier. Buenos Ayres and Belgrano shares have been quoted *ex* dividend, and the declines are, roughly speaking, about equal to the amounts of the distributions.

Telegraph stocks continue reasonably good. In spite of the slump in American Rails, Anglo-American Telegraph Ordinary and Preferred are better, but the Deferred show a loss. Eastern Extensions are again on the up-grade, and Eastern Telegraph Ordinary is marked down 3, *ex* the 3½ dividend and bonus. Western Telegraphs have been dealt in quite freely; the price improved ⅛ to 14, at which the yield on the money is the round 5 per cent. The company is, of course, in a sound financial position, and possesses a fine reserve fund. West India and Panama Second Preference have recovered to 7¼. The Trust issues are without alteration. Callender's shares have risen to 10⅜, and except for this the manufacturing group shows no material change.

Traction and Power Securities Co., Ltd.—The report for 1906 states that the net revenue amounts to £18,181, and adding the amount brought forward, there is a total of £22,092. The directors have transferred £18,850 to the investment reserve fund, and carried forward £3,242. The directors have taken £18,850 from the investment reserve fund, in order to write down certain investments to their market valuation. The remaining investments stand in the books at cost, and until their outcome is ascertained, the directors make no re-valuation of them. The investment reserve fund stands at £50,000.

Oswestry Electric Lighting Co., Ltd.—The directors report that the large expenditure on extensions, referred to in the last report, has prevented a reduction of the bank balance. The directors recommend a dividend at the rate of 4 per cent. per annum, free of income-tax, and the addition of £128 to the reserve fund.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations May 14th.	Closing Quotations May 21st.	Business done week ended May 21st, 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3½	3 — 3½	..	..	..	Nil
149 600	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11
660,660	Anglo-American Telegraph	Stock	61s.	2½%	3½%	3½%	61½ — 64½	61½ — 64½	61¾	..	..	6 0 2
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	6¼%	6 %	6 %	106⅜ — 107⅝	107⅛ — 108⅜	108	107½	+ ⅛	5 10 10
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	¼%	1¾%	20½ — 21	20¼ — 20⅝	20½	20⅜	— ⅛	8 10 9
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	5 %	..	99 —101	99 —101	..	..	..	4 19 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	..	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	5 10 4
2,097,680	Commercial Cable Stlng. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	92½ — 94½	92½ — 94½	94¼	93½	..	4 4 8
16,000	Cuba Telegraph	10	0 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	16 — 17	16 — 17	..	..	..	5 17 8
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅝ — 3⅞ xd	3⅝ — 3⅞	..	..	..	5 8 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¾ — 9¼ xd	8¾ — 9¼	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,710‡	Direct United States Cable	20	8 %	8½%	4½%	..	15⅛ — 16	15½ — 16	15⅝	15⅜	..	5 6 3
60,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	104	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	139 —144	136 —141	140⅜	139	—3	4 19 3
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	89 — 91	88½ — 90½	90	..	— ½	3 17 4
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	104½ —106½ xd	104½ —106½	104¾	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	13⅜ — 14	13⅜ — 14⅛	13⅜	13⅜	+ ⅛	4 19 1
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	105 —107	104½ —106½	..	..	— ½	3 15 2
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
2,00,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
191,127	Globe Telegraph and Trust	10	5½%	5⅝%	5⅝%	..	10⅜ — 11⅛	10⅜ — 11⅛	11	10⅞	..	4 18 10
181,127	Do. do. 6 % Pref	10	6 %	6 %	6 %	..	13⅜ — 14⅜	13⅜ — 14⅜	14 1/16	14	..	4 3 6
450,000	Great Northern Telegraph, of Copenhagen ..	10	15 %	24 %	24%	20 %	84 — 86	84 — 86	..	..	..	5 11 1
83,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	10 %	13 %	13 %	13 %	£9 — 61	56⅛ — 58½	58	..	—2½	5 15 1
266,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅞ — ⅞	⅞ — ⅞	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	4 %	5 %	..	1 1/16 — 1 1/16	1 1/16 — 1 1/16	20/-	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	1 — 1	1 — 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108 —110	108 —110	109½	108⅝	..	5 9 1
2,225 000	Do. do. Def. Stock	100	5 %	5 %	5 %	5½%	104½ —106½	104½ —106½	106	105⅞	..	5 3 4
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	11⅞ — 12½	11⅞ — 12½	..	..	..	4 8 11
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 — 12	10 — 12	..	..	..	4 3 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 5/16 — 5 7/16	5 5/16 — 5 7/16	..	..	..	4 9 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	95½ — 97½	96⅜ — 97⅝	..	..	..	3 14 10
1,689,598	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6¾%	6¾%	7⅛%	7 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 4 4
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1⅛ — 1⅛	1⅛ — 1⅛	..	..	..	4 16 0
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
11,839‡	Reuter's	8	5 %	5 %	5 %	..	7½ — 8½	7⅛ — 8⅛	8 1/16	..	..	4 14 1
60,000	Telephone Co. of Egypt, 4½ % Deb. Red. ..	100	..	..	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
8,167	Submarine Cables Trust	Cert	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
80,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	109 —112	109 —112	..	..	..	4 9 3
15,609‡	West African Telegraph, Shares	10	4 %	4½%	4 %	4 %	10 — 10⅛	10 — 10⅛	..	..	..	3 16 2
80,000	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2	Nil	Nil	Nil	2½%	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	Nil
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
207,280	Western Telegraph, Ltd., Nos. 1 to 207,280 ..	10	7 %	7 %	7 %	..	13⅜ — 14⅛	13⅜ — 14⅛	14 1/16	13⅞	+ ⅛	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —105	102 —105	..	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	3/16 — 1/4	3/16 — 1/4	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	7 %*	6 %	5 %	8 %	8 — 8½	8 — 8½	..	..	..	9 8 3
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	6⅛ — 7⅛	6⅛ — 7⅛	..	..	..	Nil
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,600 ..	100	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..	4 17

Including arrears

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

70,000	Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 560,008 to 580,007		..	8 %	8 %	8 %	7 7/16 — 7 11/16	7⅞ — 7⅞	7 25/32	7 13/16	+ 1/16	5 1 7
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	5½%	5⅝ — 6	5 11/16 — 5 13/16	..	..	— 1/16	4 4 3
266,800	Do. Permanent, 6 % Deb. Stock, 1888 ..	100	6 %	6 %	6 %	6 %	133 —136	133 —136	..	..	..	4 8 3
285,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —107	104 —107	..	..	..	4 13 6
630,000	Babcock & Wilcox, 1 to 630,000	1	17 %	20 %	20 %	20 %	3⅜ — 4	3⅜ — 4	77/6	73/-	..	5 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16 — 1 9/16 xd	1 7/16 — 1 9/16	..	..	..	3 15 7
85,000	British Aluminium, Ord., 3,001 to 40,000	5	..	7 %	7 %	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	6 1 9
40,000	Do. do. 7 % Cum. Pref....	5	Nil	7 %	7 %	..	5½ — 6⅛	5½ — 6⅛	..	..	..	5 12 0
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	..	5¼ — 5⅝	6¼ — 6⅝	..	..	..	5 4 4
20,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	..	4 — 4⅛	4 — 4⅛	..	..	..	4 8 11
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	101 —105	99 —103 xd	..	..	..	4 17 1
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	98 —101	98 —101	99	98	..	5 8 11
400,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	6 %	6 %	123 —127 xd	123 —127	..	..	..	4 14 6
800,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	106 —111	106 —111	..	..	..	£ 0 1
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	102 —106	102 —106	104½	..	..	4 14 4
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	4½%	99 —101	9⅛ —102	1.04½	..	..	4 8 3
250,000	Do. 4½ % Vancouver Power Debs., 1 to 2,900	100	4½%	4½%	4½%	4½%	102⅛—104½	102⅛—104½	..	..	..	4 6
138,801	British Electric Traction	10	6 %	6 %	2 %	..	2⅛ — 2⅜	2 — 2⅛	48/9	45/-	— ¼	12 0
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	6⅛ — 6⅜	6⅛ — 6⅜	6⅛	..	..	8 17 9
1,448,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	99 —103	99 —103	..	..	..	4 17 1
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	..	79 — 82 xd	79 — 82 xd	81	..	..	5 9 1
100,000	British Insulated and Helsby Cables ..	5	8 %	8 %	8 %	10 %	6¼ — 7	6¼ — 7	..	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅝ — 6⅛	5⅝ — 6⅛	..	..	..	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	103⅜	..	..	4 5 9
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	94 — 98	92 — 96	..	..	—2	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1 — 1½	1 — 1½	..	..	..	Nil
1,016,868	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	64 — 68	64 — 68	..	..	..	5 17 8
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,781	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	Nil	2½%	..	1/2 — 3/4	1/2 — 3/4	..	..	..	6 13 4
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1 — 1⅛	1 — 1⅛	..	..	..	8 0 0
125,000‡	Do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	89 — 92	89 — 92	..	..	..	4 17 10
125,000‡	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	75 — 78	75 — 78	..	..	..	5 15 5
100,000	Buenos Ayres & Belgrano, 1 to 100,000 ..	5	3 %	4 %	3 %	3 %	3½ — 4	3⅜ — 3⅝ xd	71/10½	67/6	..	4 0 0
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	5 — 5⅛	4⅞ — 5⅛ xd	..	..	..	5 11 10
27,500	Do "B" do. 1 to 27,500	5	6 %	6 %	6 %	6 %	4⅞ — 5⅛	4⅞ — 5⅛ xd	98/9	..	..	5 14 3
18,200	Do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	105 —107	105 —115	..	..	+3½	4 6 11
190,000	Do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 2
137,610	Calcutta Trams., 1 to 137,610	5	6 %	8 %	8 %	8 %	7⅜ — 8	7⅜ — 8 xd	..	..	..	5 0 0
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	..	..	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 6 11
850,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	105 —108	105 —103	..	..	..	4 3 4
85,000	Callender's Cable Construction shares ..	5	12½%	12½%	15%	15 %	10 — 11	10⅛ — 11⅛	10 1/8	10⅛	+ ⅛	6 13 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106⅛—108⅛	106⅛—108⅛	..	..	..	4 2 11
491,222	Cape E. Trams., 1 to 491,222	1	10 %	5 %	Nil	..	3/16 — 1/4	3/16 — 1/4	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	8 %	1⅛ — 1⅜	1 3/16 — 1 5/16 xd	24/6	24/3	..	6 1 11
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	97 —102	97 —102	..	..	..	4 8 3
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	71 — 73	71 — 73	71	..	..	5 9 7
544,216	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	92 — 94	92 — 94	..	..	..	4 5 1
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	52 — 55	55 — 58	..	..	+3	6 17 11
1,480,000	City and South London Railway	Stock	2¾%	2¾%	2¾%	2¾%	41 — 43	41 — 43	41⅞	41½	..	4 18 10
85,000	Crompton & Co., Nos. 1 to 85,000	8	2¼%	2¼%	2¼%	..	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	8 10 2
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99	96 — 99	..	..	..	5 1 0

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated, all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(Continued.)*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations May 14th.	Closing Quotations May 21st.	Business done week ended May 21st, 1907. Highest	Lowest.	Rise + or Fall —	Presen Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	..	1 15/16 — 1 31/32	1 15/16 — 1 31/32	..	..	— 5/32	7 16 10
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	..	1 1/2 — 1 5/8	1 1/2 — 1 5/8	..	..	..	4 16 0
294,150	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	102 —105	102 —105	104½	..	..	4 5 9
60,000	Dublin United Trams. (1896), 1 to 60,000	10	5½ %	6 %	6 %	..	14¼ — 15½	14¼ — 15½	..	..	..	3 18 8
59,987	Do. 6% Pref. between 1 and 60,000	10	6 %	6 %	6 %	..	13½ — 14½	13⅜ — 14⅜	..	..	..	4 2 9
99,261	Edison & Swan Utd., "A" shrs., £8 pd., 1 to 99,261	5	Nil	2½ %	4⅓ %	..	1 — 1¼	1⅛ — 1⅜	..	..	+ 1/8	9 3 9
17,189	Do. "A" shares, 01—017,189	5	Nil	2½ %	4⅓ %	..	2¼ — 2⅜	2¼ — 2⅜	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 12 0
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	89 — 92	89 — 92	..	..	..	5 8 8
112,100	Electric Construction 1 to 112,100	2	4 %	Nil	Nil	..	1/4 — 7/16	1/4 — 7/16	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	..	1½ — 2	1⅛ — 2	..	..	..	7 0 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	4 %	5 %	5 %	5 %	8⅞ — 9⅛	8⅞ — 9⅛	..	..	..	5 2 4
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	92 — 95 xd	92 — 95	..	..	..	4 4 3
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	3 %	4 %	4 %	4 %	2⅛ — 3	2⅛ — 3	..	..	..	11 0 0
96,000	Greenwood & Batley 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10⅝	10½ — 10⅝	..	..	..	6 13 4
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	15 %	11⅜ — 12⅜	11⅜ — 12⅜	..	..	..	5 17 8
200,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	3 15 7
150,000	Do. do. 4½ Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	107 —109	107 —109	..	..	..	4 2 7
50,000	India-Rubber, Gutta-Percha & Telegraph Works..	10	10%	5 %	10%	10 %	15½ — 16½	15½ — 16½	15⅜	..	..	6 3 1
37,500	†Liverpool Overhead Railway, Ord.	10	13%	11%	Nil	Nil	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	Nil
10,000	† Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %	6 — 7	6 — 7	..	..	..	7 8 2
600,070	London United Trams (1901), 1 to 50,007	10	8 %	8 %	8 %	8 %	7 — 8	7 — 8	..	..	..	8 15 6
899,980	Do. do. 60,008 to 100,000	10	8 %	6 %	8 %	8 %	7 — 7⅛	7 — 7⅛	..	..	..	5 2 2
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	5 14 3
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	85 — 89	85 — 89	..	..	..	4 9 11
314,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	Nil	1/16 — 3/32	1/16 — 3/32	..	..	..	Nil
600,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	31/32 — 1	31/32 — 1	..	..	..	5 3 11
350,000	Do. 4½ % Deb. Stock Red.	100	..	4½ %	4½ %	4½ %	96 — 99	96 — 99	..	..	..	4 10 11
30,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 50,000	5	..	6 %	6 %	6 %	4 — 4½	4 — 4½ xd	..	..	..	7 10 0
245,500	Potteries E. Trc.	1	5 %	5 %	4 %	4 %	3/32 — 1/8 xd	3/32 — 1/8	..	..	..	6 8 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/8 — 3/16	1/8 — 3/16	..	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	98½ —101½	96½ — 99½ xd	..	..	..	4 10 6
87,350	Telegraph Construction and Maintenance	12	20 %	15 %	15 %	15 %	30½ — 32½	30½ — 32½	31	30½	..	5 11 1
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	100½ —103½	100½ —103½	..	..	..	3 17 4
599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	5 %	5 %	5 %	74 — 77	74 — 77	..	..	..	6 9
66,666	Willans & Robinson, 1 to 30,000 & 30,001 to 116,666	5	3 %	Nil	Nil	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	Nil
66,666	Do. 6 % C. P., 30,001 to 30,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3⅜ — 4⅛	3⅜ — 4⅛	77/6	..	..	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	79 — 83	79 — 83	..	..	..	4 16 5

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	5 %	5½%	5½%	5½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 4 9
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	97 — 99 xd	97 — 99	97	..	..	4 10 11
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10%	8 — 9	8 — 9	..	..	..	5 11 1
10,202	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 2 4
336,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	8 %	8 %	5 %	5 %	3⅜ — 4⅛	3⅜ — 4⅛	..	..	..	5 11 1
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4⅜	4 — 4⅜	91/3	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅜ — 4⅛	3⅜ — 4⅛	..	..	..	5 5 11
427,400	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
49,436	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	4½%	3⅛ — 4⅛	3⅛ — 4⅛	..	..	..	4 14 9
175,000‡	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	6 %	9⅜ — 10⅛	9⅜ — 10⅛	10 5/16	10	..	5 14 3
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅛ — 12⅛	11⅛ — 12⅛	..	..	..	4 18 0
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	123 —126	123 —126	124½	..	..	3 19 4
300,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	97 —100	97 —100	99	..	..	4 10 0
40,000	County of Durham Electrical Power, Ord.	5	4 %	£3 7 0	4 %	4 %	4⅛ — 5	4⅛ — 5	..	..	..	4 0 0
50,000	Do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	4⅛ — 5	4⅛ — 5	..	..	..	5 0 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½%	5 %	5 %	7⅛ — 8⅛	7⅛ — 8⅛	..	..	..	5 17 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	11⅛	..	..	5 4 4
400,000‡	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
400,000	Do. do. 4½ % 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	95 — 98 xd	95 — 98	..	..	..	4 11 10
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	4 %	..	1/4 — 1/2	1/4 — 1/2	..	..	..	11 0 0
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	1⅛ — 2⅜	1⅛ — 2⅜	40/7½	..	..	10 14 5
350,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	87 — 89	87 — 90	..	..	..	5 0 0
10,000	Folkestone, 1 to 10,000	5	5½%	6½%	5½%	5½%	4⅞ — 5⅛	4⅞ — 5⅛ xd	..	..	..	5 2 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 15 3
90,000	Do. 4½ % 1st. Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
18,000	Hove, 1 to 18,000	5	8½%	8½%	9 %	9 %	7 — 7½	7 — 7⅛ xd	..	..	..	6 0 0
21,000	Kensington and Knightsbridge Electric Ord.	5	12½	12 %	10 %	10 %	8½ — 9⅛	8½ — 9⅛	..	..	..	5 0 0
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	3 %	4 %	4 %	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	5 6 8
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅛ — 5⅛	4⅛ — 5⅛	..	..	..	5 14 3
874,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 11 10
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8⅜%	10 %	10 %	8 %	6 — 7	5⅜ — 6⅜	6 1/16	5 13/16	— 1/8	6 8 0
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅞ — 5⅛	4⅛ — 5⅛	5 1/16	..	..	4 3 9
220,000‡	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	106 —110	105 —109	..	..	—1	4 2 7
350,000‡	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	88 — 92	89 — 93	..	..	+1	3 15 3
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	97½	..	..	4 11 10
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	8 %	7⅛ — 7⅜	7⅛ — 7⅜	..	..	..	5 3 3
75,000	Do. 5 % Pref., 1 to 75,000	5	5%	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	4 3 4
10,853	Notting Hill Electric Lighting	10	6 %	7 %	7½%	7½%	12 — 13	12 — 13	..	..	..	5 15 5
64,000	Do. do. 4 % 1st Mort.Deb.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6⅔%	7 %	7 %	7 %	5⅞ — 6⅜	5⅞ — 6⅜	6 1/16	..	..	5 9 10
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	12½%	10 %	7⅛ — 8⅛	7⅛ — 8⅛	..	..	..	5 17 8
30,000	Do. do. 7 % Pref. 30,001 to 40,000	5	7 %	7 %	7 %	7 %	6⅝ — 7⅛	6⅝ — 7⅛	..	..	..	4 13 4
150,000‡	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	91 — 94	88 — 93	88	..	—2	3 15 3
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	73 — 77	73 — 77	..	..	..	5 3 11
66,000	South London Electricity Supply, Ord.	5	8 %	4 %	4 %	3 %	2⅜ — 2⅝	2⅜ — 2⅝	..	..	..	5 9 1
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	Nil	2½%	2½%	3/16 — 1/4	3/16 — 1/4	..	..	..	3 6 8
117,968	Do. Do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	22/9	..	..	5 1 10
200,000	Do. Do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	6 %	5 %	5 %	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	10 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	6 %	5 %	5 %	3 — 4	2⅜ — 3⅜	..	..	— 1/8	7 2 10
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	4½%	4½%	4½%	95 — 98	95 — 98	95⅜	..	..	4 11 10
110,000	Westminster Electric Supply, Ord.	5	18½%	14 %	12 %	12 %	9 — 10	9 — 10	..	..	..	6 0 0
81,279	Do. do. 4½ % Cum. Pref.	5	5 %	5 %	5 %	4½%	5½ — 5⅝	5½ — 5⅝	..	..	..	3 18 3

(Original 5%– Red. to 4½ % from 31st Dec., 1905.

Shares not officially quoted:—Mackay Companies, ord., 70—72 — 1½. Pref. 70—72 — 1½.
Unless otherwise stated all shares are fully paid. † Interim dividends]

Bank rate of discount 4 per cent. April 25th, 1907

PUBLICITY: ANOTHER POINT OF VIEW.

[COMMUNICATED.]

(*Concluded from page* 825.)

Not less important than the Press notice is the display advertisement, which has to be paid for. In many firms there exists some difference of opinion as to whether advertising is of any value or not, some firms advertising equally year in and year out, irrespective of conditions of trade, and others being satisfied that their name is quite sufficient to cause every buyer to run to them. Between the two extremes a happy mean may be found. Only those who are quite out of touch with the times can still maintain that advertising is of no use; whilst others who spend a fixed sum on the same advertisement year after year show, by their indifference, that they are not alive to the potentialities of advertising. The proper way to advertise is to make a judicious selection of the various trade *media*, having in mind the articles required to be pushed and the amount of money from time to time available. The advertisements should be varied frequently, with the view of catching the reader's eye, but the name of the firm should always be a prominent feature. The scheme, or budget, should also be varied periodically. With regard to the amount of money to be spent, it is very difficult to lay down any rule; but it is clear that the outlay should not represent more than a small percentage on the firm's turnover when business is brisk, although a greater sacrifice ought to be made when orders are wanted.

When preparing copy for advertisements, the selling departments should always be consulted, so that those articles which require most pushing may be advertised at the right time. All advertisement copy, or proofs, should also be submitted to the respective selling departments in order that there should not be any mistakes of a technical or commercial nature. As regards the style or get-up of an advertisement, the manager of the Publicity Department should not allow his own judgment to be interfered with if he knows what he is about. A few hints in this connection may be of interest. The get-up of trade advertisements should be primarily arranged to attract the attention of the busy man. For this purpose it is often well to study the style of the neighbouring or facing advertisements (if these are regular features of the same firms), and to design something in vivid contrast. Generally speaking, all advertisements should have an illustration of sorts; plenty of white space should be allowed; the type should not be so large that the paper has to be held a yard or more away, or so small that it cannot be easily read; rules and ornaments should be avoided as far as possible, as they only tend to break up the picture and to destroy its directness. Advertisement copy should always be prepared neatly, so that the effect can be judged before it is sent to the printer; and some consideration may as well be shown to the journal by refraining from sending in copy at the last moment, as is sometimes done. This is not a sign of importance, but of bad management. Voucher copies of all journals containing the firm's advertisement should be obtained free, and until these are forthcoming the accounts should not be passed. The advertisements should be cut out and pasted in guard-books in chronological order, separate books, or sections of books, being reserved for each journal. The advertisements should be endorsed with their dates of publication, and these books will then be found most useful for repeating old ideas if necessary.

There are many other and minor functions attached to a Publicity Department which cannot be entered into in any detail here. The amount and variety of work done depends largely on the firm and on the man; on whether the latter has a free hand and is allowed to progress, or is tied by red tape, jealousy, or administrative incompetence. Not the least important work is that which comes under the general head of "routine," embracing daily correspondence, the keeping up of the many records necessary to an efficient department, the internal management of the staff, &c. No fixed rules can be laid down for these functions, as they must be carried out in accordance with prevailing conditions and environment. Only it can be said that correspondence must be properly kept, every subject and every name being entered on a card; and correspondence on important subjects or names should be filed in separate letter-boxes or covers.

In conclusion, the manager of a Publicity Department must be an opportunist, ready to take advantage of all new ideas and to modify them to his firm's current business. He must be a good organiser, pushing but extremely tactful, possessing initiative but not unduly pressing it. He must be well educated, have a good knowledge of the English language (alas! how rare nowadays), literary qualifications, and an acquaintance with the printing, paper and block-making trade. He must also possess a good general engineering knowlege. His duties involve the handling of travellers, agents and branch managers (all very sensitive persons), to say nothing of his colleagues. His position is practically the hub of the firm, and if he can succeed in impressing his directors with the potentialities of the department, and obtain from them the necessary authorisation to exercise these, his status should be of considerable importance to the welfare of his firm and of himself.

THE ESTIMATION OF STARTING RESISTANCES FOR THREE-PHASE INDUCTION MOTORS.

By D. A. TRICKETT.

If it is desired to start a three-phase induction motor of any type under load, it is necessary that the rotor circuit shall have considerable resistance, so that the phase relationship between the stator and rotor currents may permit of the necessary torque being exerted.

For small crane motors it is not an unusual thing to employ a motor with a short-circuited rotor of the squirrel-cage type, having sufficient resistance to ensure the correct phase relationship and magnitude of the rotor and stator currents.

Such an arrangement, while not so efficient as the use of a slip-ring rotor with a starting resistance which can be entirely short-circuited when the motor is in the running position, or as the use of a squirrel-cage rotor with starting resistance in the primary circuit, is very convenient from the user's point of view, owing to its low first cost and to its simplicity combined with reliability.

This argument leaves out of account the low efficiency of the arrangement, and in the case of large motors it is necessary to make the efficiency as high as possible, and to make up for the increased complication by careful design and construction, making the arrangement as reliable as is compatible with cheapness.

For large motors, laying due stress on the points mentioned above, it will be found best to adopt the machine with slip-ring rotor. This procedure is further justified by the following consideration:—

It is possible to obtain a starting torque equal to the normal full-load running torque, when taking full-load current from the line, by using a slip-ring rotor with suitable starting arrangements. Whereas, in the case of a motor having a squirrel-cage rotor, it is necessary to draw 50 per cent. above normal full-load current or more, depending on the design, from the line to produce the same starting torque. So that the larger the motor and the more arduous the starting conditions, the greater advantage will the slip-ring motor have over the squirrel-cage motor.

Roughly speaking, the sphere of usefulness of the induction motor, which can be placed directly across the mains without the use of a separate starting resistance, extends from the smallest size up to 7½ B.H.P. Between 7½ and 30 B.H.P. either the squirrel cage or the slip-ring type is chosen, taking into account the supply system and the starting performance required. For either type, the starting arrangements may consist of the well-known type of starting switch, having

three sets of contacts equally distributed round a circle. Above 30 B.H.P. there will be very few cases demanding the motor with squirrel-cage rotor, so that the slip-ring motor is practically standard.

With the above introduction we propose to briefly describe the lines upon which the resistances for such machines may be designed, stating the procedure to be adopted if complete particulars of the machine are not to hand, an event of frequent occurrence to firms who lay themselves out to deal with this class of work.

If the maximum current we are allowed to take from the line is C_1, and is equal to the normal full-load current of the motor, while the corresponding rotor current is C_2, we want to calculate the resistance it is necessary to insert in each phase of the rotor to limit the rotor current per phase to this value with the rotor at rest.

The R.M.S. value of the E.M.F. per phase in the rotor conductors with speed $= n_2$ can be expressed as follows :—

$$E = (n_1 - n_2)\,F$$
$$= C_2 \sqrt{R_2^2 + 4\pi^2 (n_1 - n_2)^2 L^2} \quad , \qquad (1)$$

where n_1 = synchronous speed,

$(n_1 - n_2)$ = the slip,

F is a factor comprising the number of conductors, the flux, &c.,

C_2 is the normal full-load current per phase in the rotor,

R_2 = the resistance of the rotor windings per phase,

L = coefficient of self-induction of the rotor in henries.

It follows from equation (1) that the E.M.F. generated in the rotor conductors at starting—

$$= n_1 F$$
$$= C_2 \sqrt{R_0^2 + 4\pi^2 n_1^2 L^2} \quad , \qquad (2)$$

where $R_0 = R_2 +$ starting resistance. (3)

Dividing (1) by (2), solving for R_0 and substituting equation (3), we find—

$$R \text{ starting} = \left(\frac{n_1}{n_1 - n_2} - 1\right) R_2 \text{ per phase.} \qquad (4)$$

From (4) it can be seen that to calculate the starting resistance, we need only know R_2 (the resistance of the rotor winding per phase) and the slip.

These can be estimated as follows :—

Assuming that we know the normal full-load current per phase in the rotor, and that the motor has an efficiency of 80 per cent., we shall not go far astray if we assume that the loss of energy in the rotor conductors is 5 per cent. of the total energy supplied to the machine. This will place us in a position to estimate the rotor resistance per phase.

The percentage slip will be approximately equal to the percentage rotor loss (5 per cent. in this case). It is now only necessary to substitute these values in equation (4), which can then be solved to find the starting resistance per phase.

If we are not informed what is the value of the rotor current, but are given the volts across the slip rings of the motor at starting, and also the primary volts and the horse-power of the motor, it follows from transformer relations that the rotor current will be—

$$C_2 = \frac{E_2 C_1}{E_1}, \qquad \ldots \qquad \ldots \qquad (5)$$

(the suffix $_1$ referring to the stator, and the suffix $_2$ to the rotor).

As soon as this is evaluated we may proceed as before, again making use of equation (4).

In the event of some cause preventing us from using normal full-load current to start, the estimation is a little more complicated.

Suppose we are told that the ratio—

$$\frac{C \text{ starting}}{C \text{ normal full load}} = A,$$

we can prove in the same way as shown in equations (1), (2) and (3) that—

$$R \text{ starting} = \sqrt{\frac{4\pi^2 L^2 n_1^2 (n_1 - n_2)^2 (1 - A^2) + n_1^2 R_2^2}{A^2 (n_1 - n_2)^2}}. \qquad (6)$$

Now L can easily be calculated by making the assumptions necessary to find the rotor starting resistance, assuming we are allowed to take the normal full-load current to start. Substitute the ascertained value of R_0 in equation (2), and from that calculate $n_1 F$ (*i.e.*, the volts across the slip rings at starting), if not already known, We are now in a position to evaluate L from equation (2). The starting resistance for the new conditions can then be ascertained from equation (6).

Having found the total value of the starting resistance, the next step is to divide it up into a number of sections.

To determine this there are two points to consider. First, what is the greatest current it is convenient to take from the mains, either for the sake of the fuses or the supply people, and secondly, what is the greatest increase of current that can be permitted per step in order that the starting switch shall not deteriorate too rapidly, owing to destructive burning of the contacts. The best modern practice seems to indicate that an increase in current of 50 per cent. above the normal full-load current (or the normal starting current) is a perfectly reasonable allowance to make to ensure that the contacts shall have a reasonably good life, provided they are correctly designed.

Having regard to these two factors, suppose we have decided that the ratio—

$$\frac{C \text{ maximum}}{C \text{ normal per phase}} = A,$$

shall hold for the motor whose starting switch is to be designed, then substituting the value for this in the formula—

$$\text{Number of contacts} = \frac{\log\left(\frac{E_2}{C_2 R_2}\right)}{\log A}, \qquad (7)$$

we can ascertain the number of contacts necessary.

The above equation (7) can easily be deduced by making a series of equations of the form—

$$n F = A C_2 \sqrt{R_0^2 + 4\pi^2 (n^2) L^2} \quad ,$$

expressing the conditions on touching one contact, on touching the next, and so on.

It is interesting to note that, provided every motor has the same efficiency, the number of contacts necessary to ensure a given percentage increment of current per contact is constant, and quite independent of the size of the motor. It can be argued, further, that we ought to expect a larger number of contacts to be provided on larger starting switches than on small ones to meet this condition, because we naturally expect to find the larger motors very much more efficient.

THE MECHANICAL DESIGN OF A STANDARD LINE OF ELECTRIC MOTORS.

By HAL LUCKIN.

Many articles dealing with the electrical design of motors have appeared from time to time, but none, I think, dealing with the mechanical side.

This being the case, and now that every manufacturer of electric motors makes a point of standardising so that he can keep a stock of either wound machines, carcases (*i.e.*, machines without windings), or of parts of machines to facilitate prompt delivery, I think that a few practical remarks with regard to points that should not be overlooked in the mechanical design of a standard line of protected motors will not be out of place, especially as I have found in all standard lines of machines that have come under my notice, that some important point which might easily have been embodied in the original design has been overlooked, and a patched-up job has been the result of trying to meet

a customer's requirements, and at the same time use in a standard machine.

The first point, and this is one that should never be lost sight of, is to keep down the number of different parts to be stocked, as by so doing you keep down the amount of capital lying idle, for money laid out in stock must be taken as such ; moreover, a certain amount of money will also be saved on patterns, as a smaller number of different parts means fewer patterns, and consequently less money to be laid out.

The best way to keep down the number of parts is as follows :—

Take, for instance, a line consisting of 12 machines. Instead of having 12 different core diameters, the machines should be designed with, say, four different core diameters, and with three different core lengths per core diameter ; this at once cuts down the number of core discs, armature nuts, end brackets, bearings, commutators, brush rockers, &c., that need be kept in stock to one-third of that required for the same number of machines each having a different core diameter.

Of course, the shafts, bearings, &c., will be larger than necessary on the shortest cores, as they have to be of a size large enough for the longest core of the same diameter, but this seeming waste of material is more than made up for in the saving on stock.

It is also understood that the same number of parts are required in the end, that is, before the machines can be sold, but as pointed out above, it is of the utmost importance to keep down stock as the above design undoubtedly does, because if you get a call for a large number of machines of one core diameter and length, you can use in, for the time being, the parts in stock for the other two lengths of core of the same diameter ; therefore, to keep a stock for a given number of machines as stated above, only about one-third of the stock required for the other design is needed.

The second point is to design the machines so that they can meet every possible requirement of customers without deviating from the standard, for it is a recognised thing that 10 or 20 machines can be built much cheaper per machine than a single machine ; also, if you can use in standard parts for a machine, you can deliver the said machine at a much earlier date than if you have to make special parts, and as many orders for small machines, say, up to 20 B.H.P. are secured, not on the selling price, but on the delivery date, it will be seen that this point is also of no small importance.

To proceed to the actual design. There are three positions in which a machine may be required to run, namely, bolted to the floor, ceiling or wall (it will be seen that I have omitted vertical machines, as this means a more or less special design, and very few, if any, makers stock them). To meet these requirements, supposing the bearing hood to be solid with the end bracket, then the feet should be on the yoke (in fact, in these days when all brush gears are adjustable except on very small machines, the feet should always be on the yoke, as it is far easier to level up the feet when they are all on one casting, which is not the case if they are cast on the end brackets), and the end bracket should have either four or eight screws bolting it to the yoke, as by this means the brackets can be moved round either 90° or 180°, and so the machine can be used in any of the three positions mentioned above. If six screws are used, this cannot be done.

Again, if the bearing hood is separate from the end bracket, four or eight screws should be used to bolt them together for the same reason ; the number of screws bolting the end bracket to the yoke would not matter in this case, but should be either four or eight, for reasons mentioned later in this article.

The next thing to consider is the drive. Now, there are three usual drives, namely, belt or rope drive, coupling drive and pinion drive. To meet these you will find that the end length of shaft, that is to say, the part which projects beyond the bearing hood, for a given horse-power at a given speed, will be required longest for the pinion and shortest for the coupling drive ; but to keep down the number of shafts or built-up cores to be kept in stock, it will be found cheaper to make only one end length ; that is to say, the one to suit the longest, as the shaft can be cut down even after the armature is wound, if necessary, to suit a coupling drive where room is scarce, although, of course, this means re-centring the shaft in case the commutator needs turning up at any time, and should not be done unless absolutely necessary.

Now, a flat and set screws with pulley a driving fit on shaft is good enough for a belt drive on small machines, but a coupling or pinion requires to be driven by a key, and, moreover, should be a forced fit on shaft. Therefore it will be better to cut a keyway in all shafts for the same reason as before, not, however, necessarily fitting a key, or rather feather, when a belt-driven machine is required.

It will be seen from the foregoing paragraph that a coupling should be a forced fit on shaft, and a pulley a driving fit ; so, in order to keep all the shafts alike, the difference in diameter should be in the bore of the coupling and pulley, and not in the shaft diameter.

Again, as the coupling should be a forced fit on shaft, this means that the bearing and bearing hood, or bearing hood and end bracket, if cast in one, should be split at coupling end, so that the bearing can be replaced without forcing off the coupling. As splitting the bearing hood and bearing throws up the cost considerably, it is as well to get out of it if possible ; a very good plan is to make the coupling a good driving fit, and drive through a feather and two set screws at right angles. This, however, should not be done on machines of over, say, 10 B.H.P. Another very good method is to leave a space between the back end of the half coupling and bearing hood so that the coupling can be driven back far enough to loosen the tapered key, which can then be withdrawn and the coupling taken off.

Another point when the coupling is forced on is to fit split oil rings at the coupling end bearing, for if solid ones are used they have to be put on the shaft before the coupling is forced on, and the chances are they will get bent in handling, and have to be cut off and replaced by split ones at the eleventh hour. Provision should also be made for fitting steady pins in the feet of machines, as this will be necessary when a direct-coupled machine is required. Of course, fitting bolts could be used ; but this means either special drilling in the feet, as all the holes are clearance holes for pulley drive, or different size screws for holding down in fitting holes to those in the clearance holes, besides necessitating hand holes in the bedplate ; and as holes for steady pins can, and, in fact, should be drilled in position, it is by far the better plan to fit steady pins in preference to fitting bolts.

The next point is to be able to turn a protected motor into one fitted with either perforated or gauze coverings for the openings, or into a totally enclosed machine. The machines should be designed so that this can be done without dismantling in any way, as to dismantle means money. The best way out of this difficulty is to make covers to fit in the openings and hold them in position by clamps or dogs, as this does away with any extra drilling.

Again, in coupling up the machine, the terminals should be arranged so that the rotation of the armature can be reversed on the terminal board without altering any connections inside the motor, which usually in small machines means partially dismantling, as there is never much room to get at the connections inside without doing so.

By allowing for four terminals on the board, one board will meet the requirements of any machine except a compound reversing one, which is not often called for, and if it were, I am afraid a special board would be required.

In the case of D.C. machines, it is often found on test that the bore requires altering. This, in the usual way, means dismantling and setting the yoke up on the boring machine and reboring. The best way out of this difficulty is to bore all the yokes with a standard bore, that is to say, the largest that will be required for that diameter of machine, and the bore can then be decreased at will by putting sheet iron liners of varying thicknesses between pole shoes and pole or pole and yoke according to the design of the machine.

A few other things should also be provided for, as they are often called for. They are as follows :—Fitting machine with fly-wheel, fast and loose pulley (when run as dynamo), brake, slow or reduction gear. A fly-wheel can easily be fitted on standard shaft by making a special pulley or coupling and bolting the fly-wheel to it.

Fast and loose pulleys can usually be fitted to standard shaft by fitting the loose pulley on the outside, that is, furthest from the bearing hood. If the end length of shaft

is not long enough to allow this, the boss of the fast pulley can be extended and machined to form the bearing for the loose pulley.

Electrically operated brakes may be easily fitted to a machine by casting the pot for brake coil on a ring which can be registered on the end bracket ring, using lengthened bolts to bolt it to bracket and yoke; the brake shoe can act on the brake pulley cast in one with coupling arranged to go on standard shaft. If a pulley drive is required, the pulley may be bolted to the coupling, and if pinion drive, a boss can be cast on the coupling and machined to take the pinion.

Slow or reduction gear may be fitted by bolting (by 4 or 8 screws) the second-motion shaft bearing hood to a ring which can register on the end bracket ring and be held to bracket and yoke by lengthened screws (a steady pin should also be fitted), which are always four or eight in number, as mentioned earlier in this article, so that this allows for the second-motion shaft bearing being moved round to suit any of the three usual positions of motor aforementioned, and at the same time allows for the second-motion shaft being used on either side of, above or below the motor, in each of the three positions.

The second-motion shaft bearing hood should not be cast solid with the yoke or end brackets, as, if this is done, it will only be suitable for one position of the motor.

I think that if machines were designed on these lines, they would meet all likely requirements of drive, &c., and it would result in a great saving to the manufacturers, and, incidentally, to the buyers.

TURBINES.

By DECAPOD.

The following is a brief account of the necessary care to be exercised in the operation of turbines for driving generators, the two most important points being lubrication and good steam.

Taking the question of lubrication first, it is usual in the case of small units for each turbine to have its own system of lubrication, which consists of a small single-acting pump driven off the end of the main shaft by means of a worm and worm-wheel, the ratio being about 14 to 1.

The oil is retained in a reservoir in the bedplate, the pump suction being taken from it through a strumm, and oil delivered to the bearings after passing through a coil of pipe surrounded by water, which circulates through a tank in the bedplate for oil cooling purposes. It is usually considered safe to work with oil temperatures of about 150° F. Care must be taken to keep the oil in good condition, and to drain off any water which may leak into the system from the cooling tank, and the condensation which creeps in from the cylinder glands through the ends of the bearings. The oil is returned to the reservoir after passing through the bearings, to be used over again; a good quality oil will last for months with care and attention, and a little addition for leakages. A pressure of from 2 to 5 lb. per sq. in. is usually allowed or applied to the bearings, according to size and weight to be lubricated.

The bearings of small size units should only have ·008 in. clearances, and there should be no fore and aft play on the spindle. The thrust bearing is only to prevent this swing, and to maintain the correct position of the spindle blades relative to the cylinder blades; any fore and aft swing is noticeable while running, and if there is any wear on the thrust it should be taken up immediately; a fine adjustment is necessary so as not to pinch the thrust rings on the spindle shaft.

If a good oil is used and proper attention given to the pump valves and cooling arrangements, no trouble need be feared from hot bearings.

A good oil, suitable for high speed running, must have the following qualifications:—Sufficient body to keep the surfaces free from contact. The greatest possible fluidity consistent with the foregoing condition. A high temperature of decomposition, freedom from corrosive action on the metals upon which it is used. A slight mixture of water not to affect the fluidity.

Good Steam.—A most important point in connection with good and satisfactory running is to always supply the steam at as near as possible the same pressure and temperature; 5 lb. variation in steam pressure should be the maximum, and with reasonable care on the part of the stokers, this should be easily obtained, especially in lighting stations. Of course, with heavy units for railway work, it is practically impossible to obtain so good a result, but where good governing is desired, every effort should be made to keep the steam pressure as nearly uniform as possible.

Superheaters should receive careful attention, and the amount of superheat should be kept as near the maximum level as possible, as constant changes of temperature in large sets affect the smooth running.

Boilers with an inclination to prime should always receive immediate attention, and where sudden demands for steam are made and forced firing becomes necessary, the steam requires to be efficiently baffled to separate any water from the steam when leaving the boiler. Should entrained water be allowed to pass through the turbine, sooner or later trouble will ensue from wear on the nozzles and impulse blades, owing to the tremendous velocity of the steam; and should there be any sediment in the water, this will lodge in the spaces between the blades and gradually fill them up, materially affecting the output of the turbine, often as much as 50 per cent., and making it necessary to open up the turbine in order to clear out the sediment. The fact, also, that the turbine is controlled by an equilibrium valve, which has a continuous reciprocating motion, actuated by the main steam, against a spring which is adjusted to suit the steam pressure, makes constant full pressure necessary for good control by this valve.

The function of this type of governor is to alter or vary the plane of oscillation of the equilibrium valve. The steam is thereby admitted in puffs either of long or short duration, according to the load. At full load the puffs merge into an almost continuous blast; this does not mean better expansion of the steam, it simply means that high-pressure steam is used at all loads. The actual expansion of the steam is taken care of independently in the blades.

It is advisable to examine and test the safety governor at regular intervals of time, or, better still, make it a rule always to shut down by the safety arrangement, and so make sure it is in working order. The writer once had an instance where, due to heavy priming of the boilers, carrying sediment over into the turbine, the relay valve stuck full open, causing the turbine to race, and the generator circuit-breaker came out. The result was, a very dangerous speed was reached before the steam could be shut off. The safety governor was stuck from the same cause.

Great care should also be taken with the thrust bearing, as slight wear is apt to cause serious trouble.

It is about time that turbine builders made arrangements for taking clearances both top and bottom, also fore and aft, without having to dismantle the turbine. Braced hand-holes could be made for this, so that the above clearances could be taken without any loss of time and with a minimum of trouble. This would enable a more careful and necessary inspection to be made as often as the lengths of runs required.

Large turbines should be fitted with small permanent pipes to the commencement of each expansion, so that a record of the expansion pressures may be taken at any time without difficulty.

The length of time required to warm up a turbine ready for the load depends, of course, on the size, but assuredly the best method is to open up the by-pass to the main valve and allow sufficient steam to flow to warm up. If, say, after about 5 minutes the machine is ready to run up, another 5 minutes should be taken in running up, making a total of 10, the machine will then be ready for the load. This time will be quite sufficient for sizes up to 1,000 KW.; if larger, a little longer time should be allowed, except in cases of emergency, when it is usual to run up with all speed. Of course, a heavy dose of water is not to be treated lightly; considerable damage can be quickly done, such as twisting the blades, and causing them to foul with disastrous results to the vital parts.

The writer has seen several turbines damaged, due to heavy doses of water. Certain amounts, not sufficient to do any actual damage, have the effect of slowing up the machine until it clears itself.

A double-flow turbine runs less risk of damage than the single-flow type from water trouble, a point worthy of consideration in large power houses. The double-flow turbine has also another advantage over the single-flow, namely, the absence of balance pistons. The latter have been a source of trouble in turbine running, due to the difficulty of getting them sufficiently steam-tight to give good longitudinal steam balance. Double-flow machines are also the best type for heavy overloads, momentary or continuous.

MASTER AND MAN.

By BEN FRANK.

JUST as the train was starting, the door was opened and a tall gentleman, panting and flushed with hurrying, jumped in. His back was towards me as he put his hat and umbrella on the rack, but when he turned round to take his seat in the opposite corner to the one I occupied, saying, as he did so, "I am afraid I should have missed the train, had it started punctually," we recognised each other.

"I thought you were in Germany," I said, "when did you get back?"

"Oh," replied Tindell, "I have been back for a couple of weeks or so, but I have not been much in town. Do you usually catch this train?"

"Well, this is really my first day at business since I took the family down to Brighton, but I intend to return by this train every day, if I can manage it. It gives one time for a breath of briny before dinner. And how did Germany strike you? Things are pretty busy over there just now, are they not?"

"Busy! they are absolutely choked with work. Turning out dynamos and motors like shelling peas, and no worry with the men. Why, if we were as busy as they are, we should have the whole trade out on strike for higher wages. They stand no nonsense there from the workmen; in fact, the men know their place and keep it."

"But," I interposed, "they *do* have strikes sometimes, I believe; although I understand the Trade Unions are not so powerful over there as they are here."

"Well, from what I saw, the German workman seems more keen on his work, and sticks into it more than the average Trade Unionist over here does. No doubt the military training has something to do with it. A man looks upon his foreman as his superior officer, and not as a pal. Besides, a man stands a chance of being clapped into prison if he is out of work. As a matter of fact, I think that German employers are just a little bit *too* despotic, and there will be a big flare-up one of these days.

"To give you an instance of what I mean," continued Tindell, "when I was in Berlin I spent some time in Northeim's works. You could drop our works—and they are not small—into one corner of Northeim's, and you would hardly see them. Talk about system! Those works are just like clockwork, and are treated as clockwork. If anything goes wrong, it is not the system that is at fault, but one of the parts, and that part is scrapped, no matter what it is. As we were going through the drawing office, Northeim stopped to ask the chief designer a question about a drawing that had gone out into the works. There was something wrong about it, and it had caused trouble. Having found out who was responsible, he said, 'Very well, give him notice to leave at the end of the week.' And that was the end of it."

"I could not help saying to Northeim," continued Tindell, "that it seemed a bit rough on the chap to be summarily dismissed like that without hearing a word of explanation. Perhaps there was some excuse; or even if there were not, everyone is liable to make a mistake; we are only human. And again, looking at it from the human point of view, possibly the man had a mother, or a wife, or a child depending on him."

"'My dear Sir,' said Northeim, 'I do not regard these people as human beings at all so far as this works is concerned. Outside, they may be; but in here they are machines, and parts of the whole system of machinery. If a part goes wrong, it throws other parts out of gear, and that will not do—out it goes. I think no more of discharging a man, or a member of the staff, who makes a stupid mistake which upsets the general system, than of scrapping a faulty casting.'"

"What a heartless, inhuman beast he must be!" I exclaimed. "I don't think that sort of treatment would be tolerated over here."

"Well, I simply could not do it," replied Tindell. "We are on very good terms with all our staff, and they look upon us as friends as well as employers. That's the right way to conduct a works; let your men feel that they have an interest in the concern, and that there is a place for them so long as they study the firm's interests. We don't expect infallibility any more than we claim it for ourselves."

"Quite right, too," I said; "it was brutal. By the way, what has become of Player lately? I have not met him on the golf links for quite a time."

"Oh, I have not seen him since he left us. You knew that he left us a month or so ago, did you not?"

"Left you!" I could not conceal my astonishment.

"Why, I thought he was a fixture. He has been with you for about 20 years, hasn't he; practically ever since the firm started? I always looked upon him as being one of the firm, or next door to it."

"Well, you see," hesitating—"We have our own sons coming on. We must consider them first, you know. I think Player felt it rather, after being with us so long; but he was getting a bit stale, and we thought it would be better to have a younger man with fresh ideas."

"Oh, I see, then he did not leave of his own accord to take up a better position! and where is he now?"

"As a matter of fact I don't think he is settled in a new berth yet. But he will be all right, he is a clever chap, and will be all the better for a change. I dare say we felt parting with him, more than he did. He had sort of grown up with us, and, as you say, we had come to look on him as one of ourselves. We had a farewell social and gave him a nice little send off, and presented him with a gold watch as a souvenir of his long association with the old firm. It was quite a pathetic little gathering I can tell you. Very different from the way Northeim treats his men, eh?"

And as I strolled along the sea front in the cool of the evening, I could not rid myself of this question—which, after all, is the more brutal or inhuman, to summarily dismiss an employé for a stupid blunder—an employé who fully expects dismissal as a matter of course—or to dispense with the services of an old servant who has helped to build up the fortunes of the firm—whom one has come to regard as a friend—because he has become stale or old-fashioned? It was a somewhat involved question, but a very persistent one, and the idea was gradually borne in upon me that, in the final reckoning, there can be only one real relationship between employer and employed, namely, that of master and man.

PROCEEDINGS OF INSTITUTIONS.

"Flexibles," with Notes on the Testing of Rubber.

By Prof. Alfred Schwartz, Member.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 18th*, 1907.)

(*Continued from page* 822.)

VI.—Effect of High Temperature on Rubber.

Under the influence of high temperature rubber develops many defects, of which the following are the chief:—

1. *Loss of Strength or Cohesion.*—Rubber with a comparatively low coefficient of vulcanisation is liable to develop this defect, particularly if the time for vulcanisation has been short, as is not unusually the case with flexibles.

2. *Hardening with Brittleness.*—This defect appears in rubbers containing white substitutes (chlorosulphides), but more commonly is due to the presence of a considerable amount of free sulphur.

3. *Stickiness and Darkening in Colour.*—This defect is associated with rubbers containing mineral oils, large quantities of recovered rubber, or large proportions of sulphide substitutes.

In order to test the effect of high temperature on pure and vulcanised rubbers, a number of samples about 3 in. long, cut from wire, were kept continuously at a temperature of 100 to 105° C. Three samples were withdrawn each day, and tested, for breaking load and extension. The pure rubber was quite unable to withstand this temperature, and melted. The vulcanised rubber rapidly deteriorated both in tensile strength and percentage elongation. The results of these tests are shown graphically in figs. 4 and 5.

A further series of deterioration tests on C.M.A. vulcanised rubber was carried out at 150° F., and the results are shown

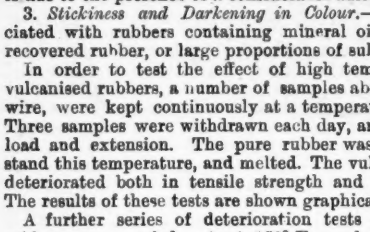


Fig. 4.

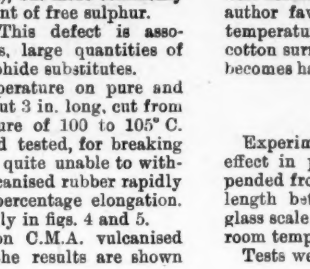


Fig. 5.

Fig. 4.—Effect of Heat on Tensile Strength of Vulcanised Rubber.

Heated in air for eight days at 100-105° C. Length of test piece, 1·8 cm.

Fig. 5.—Effect of Heat on Vulcanised Rubber.

Curve A, percentage extension of new sample at 60° F.
Curve B, extension of sample of same material after heating in air at 100° C. for eight days.

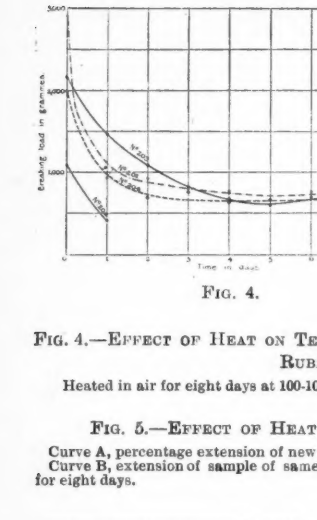


Fig. 6.

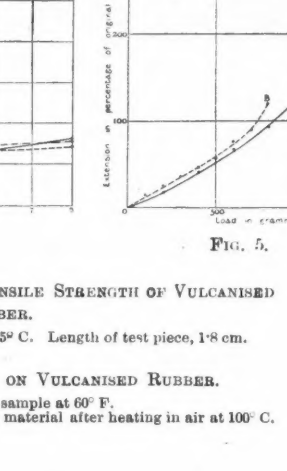


Fig. 7.

Fig. 6.—Effect of Heating Vulcanised Rubber at 150° F.

Curve A, breaking stress, C.M.A. flexible, firm D.
Curve B, per cent. extension, C.M.A. flexible, firm D.
Curve C, breaking stress C.M.A. flexible, firm C.
Curve D, per cent. extension, C.M.A. flexible, firm C.

Fig. 7.—Hysteresis Curves for Pure Spread Rubber Sheet.

Width, 0·71 in. Thickness, 0·025 in.

A. Length, 7·88 in. Time between applying load and taking reading = 30 sec.
B. „ 7·88 in. „ „ „ „ „ „ „ = 2 min.
C. „ 1·97 in. „ „ „ „ „ „ „ = 2 min.

graphically in fig. 6, the points plotted being in each case the mean of three experiments.

A consideration of the curves in figs. 4, 5 and 6, together with the results of heating in carbon dioxide, would appear to indicate that:—

1. The greater part of the deterioration is due to oxidation.

2. A certain amount of deterioration goes on in the absence of oxygen, and possibly some change in the state of the vulcanisation may take place.

3. Although the rate of deterioration is fairly constant over a considerable period, it would be advisable to extend the dry heat test over a longer period than one hour, which is the present practice.

4. An extension test after a period of heating at 150° F. is desirable to discriminate as to the probable durability of the materials employed.

The question as to which of the two classes of rubber gives the best results in such a high temperature is a debatable one. The author favours the view that pure rubber is best suited for high temperatures, since if it does soften and melt, it is absorbed by the cotton surrounding it, whereas in the case of vulcanised rubber it becomes hard and friable and disintegrates on bending.

VII.—Hysteresis of Rubber.

Experiments were carried out on the mechanical hysteresis effect in pure and vulcanised rubbers in the form of strip, suspended from a clip and loaded directly by means of weights; the length between two marked points was measured on a vertical glass scale behind the rubber. Throughout the experiments the room temperature was 61° F.

Tests were first made on commercial pure rubber strip, as used for insulating purposes; this strip is prepared by the spreading method. The results are shown graphically in fig. 7. Curve A was obtained on a 20-cm. length, the readings of the extensions being taken 30 seconds after adding or subtracting the loads. Curve B was obtained on the same piece of rubber used for curve A, the readings in this case being taken after a lapse of two minutes; the load also was carried to a higher value. It is evident from a consideration of these curves that with low loads the hysteresis effect is small, and that the time (between the limits named) allowed to elapse between the alteration of the load and the reading of the extensions does not affect the results to any great extent. With large loads, however, this time lapse is very important, as the rubber flows considerably. In all the following experiments a two-minute interval was allowed. Curve C, fig. 7, shows the loop obtained with strip of the same dimensions as in A and B, but with the stress increased nearly to the breaking point of the rubber. The ordinate OC_1 represents the "permanent" set in the rubber. This is really a very variable quantity, as rubber possesses considerable power of recovery; in this instance OC_2 represents its value after a lapse of 16 hours.

Fig. 8 shows the results obtained with "cut" strip. This material possesses very different tensile strength according as it is tested with the grain or across the grain, the "grain" being due to saw marks in cutting. Curve A is for "with the grain" and B for "across the grain."

Experiments were made on C.M.A. vulcanised rubber stripped from flexibles supplied by four separate firms.

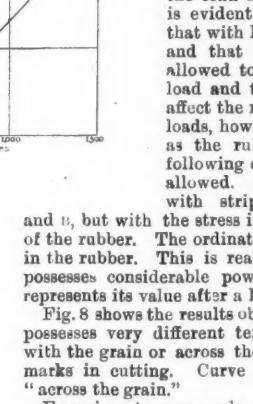


Fig. 8.

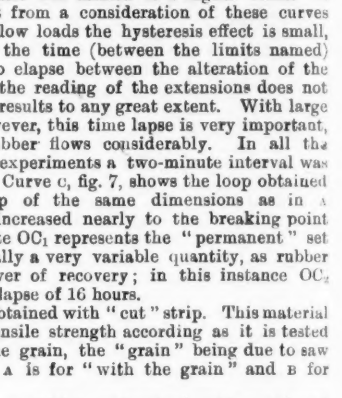


Fig. 9.

Fig. 8.—Hysteresis Curves for Pure "Cut" Rubber Strip.

Width, 0·39 in. Thickness, 0·036 in.

A. Length, 0·39 in. Tested with the grain.
B. „ 1·97 in. „ across the grain.
Room temperature, 60° F.

Fig. 9.—Hysteresis Loops for C.M.A. Flexibles 40/36.

A = Firm A, breaking load 590 lb. per sq. in. % extension on rupture 375.
B = „ B „ „ 440 „ „ „ „ „ „ „ 325.
C = „ C „ „ 440 „ „ „ „ „ „ „ 325.
D = „ D „ „ 650 „ „ „ „ „ „ „ 366.

Samples sold as being equal to C.M.A. insulation (I) and non-association wire (II and III):—

I. Breaking load 540 lb. per sq. in. % extension on rupture 129.
II. „ „ 140 „ „ „ „ „ „ „ 162.
III. „ „ 370 „ „ „ „ „ „ „ 91.

The results are shown graphically in fig. 9, together with the results for material purporting to be of equal quality to C.M.A., but which an analysis showed to be composed of low-grade ingredients.

The author suggests that by arrangement with the Cable Makers' Association a standard hysteresis loop might be arrived at for given grades of insulation. Such standard loops would to a very considerable extent serve as vulcanisation standards, and would secure the necessary physical properties of the material which give an indication of its durability, while they would further undoubtedly conduce to uniformity of manufacture. The apparatus required is simple and inexpensive, and the test is quite easy to carry out.

VIII.—The Stretching of Rubber.

Apart from the hysteresis test, the stretching of rubber in the author's view forms one of the best guides as to its quality at the outset, and also affords an indication as to its probable lasting qualities.

The author claims that the stretching test will discriminate between good and bad rubber, though not so fully as the hysteresis test will do.

The disturbing effect of the dimensions is not very large except in the case of width; very wide strip should be avoided, owing to the difficulty in clamping it so that the stress is evenly distributed.

A reduction in the amount of sub-permanent set goes on throughout the 24 hours after testing; indeed, it will continue as a diminishing quantity for several days. The amount of "permanent" set increases with the time the specimen is under tension, and also depends upon the rate at which the stretching takes place. There does not seem to be any gain in measuring the "permanent set" a number of hours after release.

IX.—Tests on Completed Flexibles.

In the spring of last year, at the instance and for the information of the Wiring Rules Committee of this Institution, the author carried out in the laboratories of the Municipal School of Technology, Manchester, the following series of tests on complete flexibles:—

1. Tensile strength.
2. Bending on a counterweight fitting.
3. Dielectric strength I.E.E. rules.

TABLE I.—Mechanical Strength of Flexibles.

Test piece reference number.	Size.	Breaking load on flexible in lb.	Bending test. Number of times up and down.
1 a	35/40	71	58,850
1 b		93	
2 a	35/40	127	181,470
2 b		138	
4 a	23/36	104	70,181
4 b		82	
5 a	23/36	60	130,699
5 b		82	
10 a	35/40	93	9,560
10 b		194	
12 a	35/38	116	340,000
12 b		105	

1. *Tests for Tensile Strength.*—Table I shows that the breaking force varies a good deal with different specimens of the same sectional area. This is probably due to the way in which the twin conductors are twisted together, for if one is slightly shorter than the other it will bear a larger proportion of the load. The tests show, broadly speaking, that flexibles of the sizes submitted will break with about 100 lb. when new. This is very much in excess of any load they are likely to be called upon to bear. As might be anticipated, the copper in nearly every case breaks before the rubber. It breaks very cleanly right across all the strands with a considerable reduction of area, hardening, and loss of flexibility. In the case of C.M.A. flexible supplied by two different firms the rubber broke first. Where the copper breaks first and the load is removed, the rubber will contract and bring the broken ends of the wires into contact, and so give rise to arcing. This is not very likely to occur in practice, but the author finds as a result of a series of tests on repeated bending through a right angle at a lamp-holder, that the copper in this case also breaks first, and that the broken ends are almost invariably pulled together again by the contraction of the rubber when the weight of the fitting is taken off the cord. The average percentage elongation before rupture on a 12-in. length was 25 per cent. Test pieces were cut from flexible that had been in use in the School of Technology, Manchester, for the past five years; the tests (No. 12) show that practically no deterioration as regards tensile strength has taken place. There was, however, a notable decrease in the percentage elongation (12 per cent.) due doubtless to the hardening of the insulation, and to the slack in the twisting being taken up by the weight of the fitting. It may possibly also be due in part to the hardening to which copper is subject if left for a long time under even moderate loads.

2. *Bending Test on a Counterweight Fitting.*—One of the severest conditions that a flexible conductor has to meet in house installation work is its use on an ordinary counterweight fitting. An apparatus was arranged to simulate as nearly as possible the bending met with under working conditions. The flexible was drawn down by an attachment to a small motor and drawn up again by the counterweight once in each revolution of the motor. The motor, which was $\frac{1}{12}$-H.P., was fed through the flexible under test, and the revolutions counted until a breakage occurred in the conductor, when the motor stopped. The following are the particulars of the apparatus:—

Diameter of porcelain pulley	1½ in.
Length of pull	6 „
Weight of counterweight	1¾ lb.

Some of the results are incorporated in Table I, and are certainly surprising as to the extent of the endurance of flexibles under such conditions. Since the conclusion of these tests the author has received from Mr. Mervyn O'Gorman a specimen of special "gymp" flexible, the structure of which has already been referred to under the head of conductors. After running over 1,600,000 times up and down over the counterweight pulley, the condition of this flexible was, as far as one could see, quite unaffected, and the attempt to break it was abandoned. The author understands that this material costs about £60 per mile, and the resistance is very high, amounting to 1·70 ohms per yard of double conductor on the specimen tested. In connection with lifts and hoists, when the ordinary flexible gives a good deal of trouble, the use of "gymp" flexible would appear to be advantageous.

Bending Tests through a Right Angle.—Flexibles in mills and factories are subjected to frequent brushing to rid them of adherent dirt, and this entails bending at the lamp-holder; also counterweight fittings are usually adjusted by grasping the lamp shade, with a similar result. In order to ascertain the effect of repeated bending, the author tested about 60 varieties of flexible in the following way:—Five lamp-holders were mounted in a line on a wood batten with a short length of flexible depending from each, to which a 3-lb. weight was attached. The ends of the flexibles in the lamp-holders were connected in series, and a small motor ($\frac{1}{12}$ H.P.) was fed through this circuit. The motor was arranged to rock the lamp-holders through a right angle about the ends of the cord grips as centre once each revolution. When a conductor broke, the motor stopped, and the reading was taken on the revolution counter attached to the motor. The flexibles were carefully inserted and treated as far as possible in the same way; a selection from the results is given in Table II.

TABLE II.

Bending Test through a Right Angle at a Lamp holder.

Size of conductors.	Average breaking load, in lb.	Number of right-angle bends under tension of 3 lb.	Description of insulation and finish.
61/·006 = 1/18	135	1,680	V.I.R. glacé twin twisted
61/·006	—	86,810	V.I.R. workshop
61/·006	—	8,250	V.I.R. glacé circular twin
35/·006 = 1/20	93	780	V.I.R. glacé twin twisted
35/·006	101	3,680	V.I.R. silk twin twisted
35/·006	—	7,050	V.I.R. circular twin
23/36	—	870	C.M.A. glacé
23/36	—	4,910	C.M.A. glacé
40/36	134	5,010	C.M.A. glacé
40/36	—	154,900	C.M.A. workshop
40/36	—	2,490	C.M.A. silk twin twisted

Considerable differences exist in the behaviour of different conductors of the same sectional area and gauge of wire. This may be due in part to differences of manufacture or material, but the author is inclined to attribute it to the position of the flexible where it entered the cord-grip and where the bending took place. The two conductors may have the axis of their cross-sections at right angles to the axis of bending, or parallel to it, or in any positions intermediate to these. In practice any of these positions may be dealt with, and the figures given may therefore be taken as an indication as to what might occur in actual work.

3. *Dielectric Strength.*—The samples were first subjected to the insulation test as set out in the 1903 edition of the Wiring Rules. The flexibles were suspended from supports 3 ft. apart, and were at their centres about 4 in. from a pan of boiling water 14 in. in diameter. All the samples submitted successfully withstood the I.E.E. test, and were afterwards tested with a gradually increasing alternating-current voltage until they broke down (Table III).

TABLE III.—Dielectric Strength of Flexibles.

Test piece reference number.	Thickness of rubber in mils.	Breakdown pressure in volts.	Nature of insulation from observations.
1	16	8,000	Cotton over conductor, V.I.R. only.
3	27	24,200	V.I.R. separator and pure rubber with longitudinal joints.
5	35	26,000	V.I.R. separator and pure rubber of good quality. No cotton next conductor.
7	8	5,100	Cotton braid, cotton yarn, single layer pure rubber. Cotton next conductor.
8	24	25,000	Cotton braid, double layer pure rubber. Cotton next conductor.

X. Testing of Insulation.

The features which it is desirable that the insulation should possess, in the order of their relative importance, are durability, high initial insulation resistance and dielectric strength. The first is undoubtedly in the case of flexibles the most difficult to obtain, and also the most difficult to test for; while the second, although very generally considered of small importance, often affords a safer guide to the real character of the insulation than the high-voltage puncture test would do.

The cheaper grades of insulation do not retain their elasticity. Neither the puncture test values nor the initial insulation resistance afford accurate indications of the durability of the rubber.

Pure fine Para rubber contains about 1½ per cent. of matter soluble in acetone, but during the process of vulcanisation this increases to from 3 per cent. to 4·5 per cent. Oxidised oils and rubber substitutes are soluble in acetone, so that the percentage of

acetone extract above that native to good vulcanised rubber is a guide to the purity of the rubber.

In order to recognise the relation of the resinous extract obtained to the amount of india-rubber present, the percentage figures for these two constituents should always be calculated separately, so as as to show the absolute percentage of resin contained in the india-rubber of the sample alone, and not in the whole contents of the compound.

The increase in the resinous extract only occurs in rubbers vulcanised by heat; cold vulcanised rubbers invariably show the normal percentages of resin.

The following specification has recently been agreed to by the American Rubber-Covered Wire Engineers' Association:—*

"For insulating compound containing not less than 30 per cent. by weight of fine dry Para rubber.

"The vulcanised rubber compound shall contain not more than 6 per cent. by weight of acetone extract. For this determination the acetone extraction shall be carried on for five hours in a Soxhlet extractor as improved by Dr. C. O. Weber.

"The rubber insulation shall be homogeneous in character, shall be placed concentrically about the conductor, and shall have a tensile strength of not less than 800 lb. per sq. in.

"A sample of vulcanised rubber compound not less than 4 in. in length shall be cut from the wire with a sharp knife held tangent to the copper. Marks shall be placed on the sample 2 in. apart. The sample shall then be stretched until the marks are 6 in. apart and then immediately released; one minute after such release the marks shall not be over $\frac{1}{8}$ in. apart. The sample shall then be stretched until the marks are 9 in. apart before breaking. For the purpose of these tests care must be taken in cutting to obtain a proper sample, and the manufacturer shall not be responsible for results obtained from samples improperly cut."

Dry and Moist Heat Tests.—The following tests are generally referred to as "Admiralty tests":—

The "dry heat" test is carried out in an air bath and consists in exposing the samples for one hour to a temperature of 270° F. The "moist heat" test is carried out in a digester at 320° F, the samples having to withstand this temperature for three hours without injury. This test is purposed to disclose the presence of rubber substitutes by their saponification. Pure rubber will not stand these tests, as it melts.

The following elongation test is attributed to the Admiralty, and is certainly the best in common use at the present time:—A 14-in. specimen to be clamped for 1 in. at the ends and stretched to double its length—*i.e.*, 24 in.—to remain in this state for 24 hours without breaking, and on release after a further 24 hours the permanent elongation on the 12-in. length should not exceed 15 per cent.

A consideration of the existing tests *detailed above* shows a great lack of uniformity and an undoubted want of a reliable "durability" test. The author suggests that a comparison with a standard hysteresis loop, together with a carefully specified stretching test after heating at 150° F. for a given time in air, would give much greater certainty as to the probable durability of the material than any of the tests referred to above.

XI.—Thickness of Insulation.

Where a material of fairly constant composition, such as fine Para rubber, is employed, a specification of the thickness to be used may be of value; but with a highly variable material like vulcanised rubber the specification of the thickness to be employed is not of much value as a guarantee of the subsequent satisfactory behaviour of the material. The minimum thicknesses specified in the regulations of various countries are as follows:—

English.—Pure rubber, I.E.E.:— 16 mils up to 125 volts. 20 „ 250 „

Vulcanised rubber C.M.A. ... ... 34 mils smallest conductor. 37 „ largest „

American—Vulcanised rubber:—31 mils minimum.

		Diameter of core. 1 mm.	2 mm.
French—Vulcanised rubber:—	(*a*) "Medium" insulation	24 mils.	28 mils.
	(*b*) "High" insulation ...	32 „	36 „
	(*c*) "Very high" insulation	40 „	40 „

For pendants the thickness may be reduced to 16 and 24 mils for classes *a* and *b* respectively if braided with waxed silk.

German (see Appendix).—Vulcanised rubber, smallest conductor: maximum 43 mils, minimum 31 mils; largest conductor: maximum 55 mils, minimum 39 mils. For counterweight cord, minimum 23 mils.

The vulcanising rubber may be applied to the conductor in two ways. In the first method, which is most commonly adopted in this country, the conductor, after being lapped with pure rubber tape, is laid between two ribands of vulcanising rubber, and passed between two grooved steel disks so placed that the grooves form a die of the required diameter. The disks are furnished with cutting edges which shear off the superfluous rubber and cause the freshly cut edges to unite by pressing them together. After vulcanisation the joint is considered to be as strong as the remainder of the material. The author has tested these joints by removing a short length of the conductor and blowing out the tube of insulation thus formed by means of a bicycle pump and valve, and has found that in most cases the joint yields first.

The second method consists in forcing the vulcanising compound by means of a screw worm round the conductor as it passes through a die, much in the same way as the lead covering is formed round a cable. In order that the rubber may flow freely the apparatus has to be warm, and the finished insulation must be allowed to cool and harden before coiling. This method is largely used on the Continent and in the United States, and although the joint is eliminated, which may be considered an advantage, the conductors will very frequently be found to be considerably decentred.

A cotton wind over the conductors, which is absent in the case of C.M.A. flexible, seems to be desirable, as it prevents the direct contact of the pure rubber and the conductor, which is injurious if the tinning is defective. It also prevents the insulation from sticking to the wires, which it does very tenaciously, making it difficult to get out all the wires for connecting purposes, and it further keeps these wires clean and free from rubber.

XII.—Flexible Wiring Systems.

These systems, in which flexibles supported on insulators are employed, are used to a considerable extent on the Continent, on account of the cheapness and ease with which they may be installed.

The best known and most widely used of these systems is that of Peschel; it was introduced in Germany in 1893 as being cheaper than wood casing and having a less fire risk.

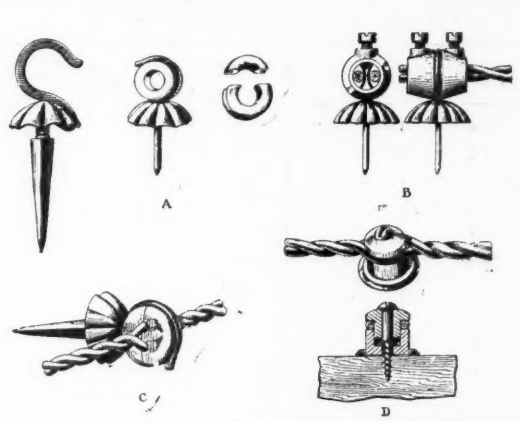


Fig. 10.

Originally the so-called ring insulators were employed on this system, the conductors hanging from them in a series of loops, but they are now only occasionally used. They consist of grooved rings of porcelain or coloured glass, either in one piece or split, the latter being used in order to put in extra support to a wire which has already been run, or for heavy cable. These rings are sprung into small spring hooks furnised with either pins, nails, screws or eyes, as shown at A in fig. 10.

To strain up the flexibles at intervals, special clamp insulators

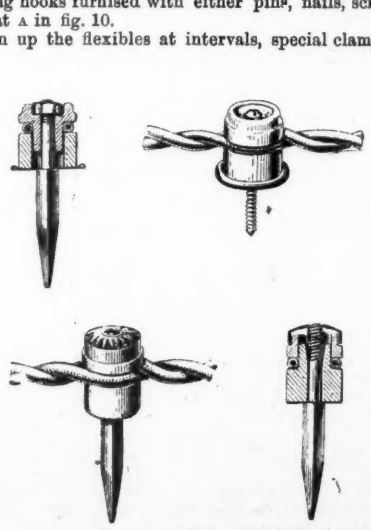


Fig. 11.

are required. They consist of a short porcelain tube, in which the flexible is held fast by two screws forced down between two fibre strips, causing these to wedge the cord against the tube, as B in fig. 10.

Another form of grip insulator, shown at C, in fig. 10, consists of a split insulator with two or three ribbed channels in which the cords are more or less tightly held when the insulator is clamped by the spring hook. The installation of the unsplit rings is inconvenient

* W. S. Clark, *Proceedings* American Institute of Electrical Engineers, Vol. XXV, No. 4, 1906, p. 203.

and unsatisfactory, in that the flexibles are frequently slack, and the wire is damaged when the rooms are cleaned, and further, the supporting of the hooks by pins or nails is not very sound except when used on woodwork.

A very much better job is made by employing the type of insulator shown at D in fig. 10, where, on screwing up the fixing screw, one part of the insulator telescopes into the other, gripping the cord between the edges.

In the School of Technology, Manchester, a room has been wired as an example of this system, and has given no trouble during the six years it has been installed. The flexibles, however, when fixed on the Peschel system, are only about ½ in. from the walls, and in order to give sufficient space to allow of the walls being distempered without removing the wirings, these insulators in Manchester have been mounted on paterases. The flexibles on the Peschel system may, if desired, be taken down and replaced when the redecoration is completed.

An improved form of insulator ("Reformrolle") has been placed on the market by Hartmann and Braun, which possesses the considerable advantage that the pressure exerted on the flexible is quite independent of that required for the fixing of the insulator. The various forms are shown in fig. 11.

The clamp insulators with flexibles are very popular in Germany, one firm alone supplying many millions annually. They are also largely used in France, Italy, Belgium and Switzerland. There is a tendency now to run the wires in metal tubes, to secure additional mechanical protection where the lowest prime cost is not an absolute essential.

In Germany cotton-covered flexible costs from 2d. to 4½d. per metre, and silk-covered from 4d. to 7d. The prices of the insulators vary from 6d. per 100 for white glazed porcelain to 4s. 10d for the "Reformrolle," which are intended for well-decorated rooms. It is claimed that flexible wiring can be installed without making a mess or injuring decorations, and in Germany the cost per point, exclusive of the lamp-holder, &c., varies from 10s. to 18s.

(To be concluded.)

Electrical Cranes for Shipbuilding Berths.

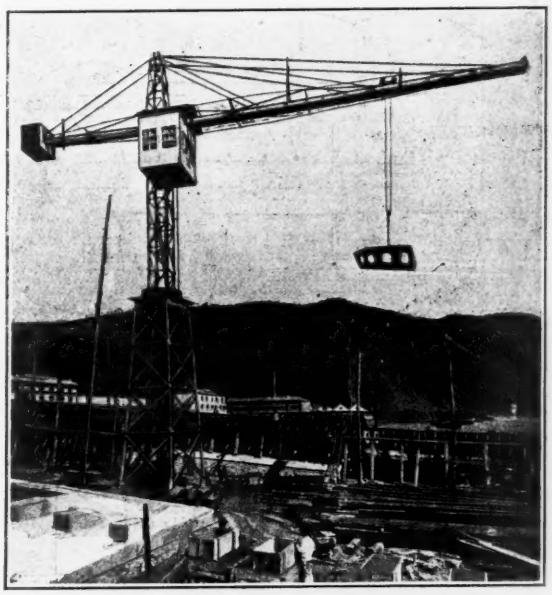
In a paper recently read by Signor Carlo Piaggio before the Institution of Naval Architects, the author considers the question of labour-saving appliances in dealing with shipbuilding materials, more particularly referring to the use of electric cranes for shipbuilding berths by the Società Esercizio Bacini, at Riva, near Genoa.

As none of the systems in use in 1904 was found to answer the purpose perfectly, a special equipment was designed, which satisfies the following requirements:—

1. Ability to take materials lying on the ground in any part of the yard near the berths, and to carry them rapidly to the exact position on the vessels being built.
2. Moderate first cost and expense of up-keep.
3. Greatly reduced incumbrance.
4. Possibility of carrying on work in different parts of the vessel at the same time and independently.
5. Possibility of launching vessels with masts and funnels in place (this condition is important only for shipyards which, like those in Italy, launch vessels completely finished).

The plant consists of six electric tower cranes of 1·5 tons capacity each, placed in two rows, three on each side of the central berth, and as near as possible to the side berths; the spacing depending upon the breadth of vessels which are to be built. In 1906 a new crane was added; the height of the jib of this crane is 90 ft. Each crane consists of a steel lattice-work tower of prismatic shape fixed on a concrete block. In the centre line of the tower is placed the turning mast, which is supported by a bearing fixed on the concrete block and kept vertical by rollers fitted on the upper part of the tower. The horizontal jib on which the load truck travels, consists of channel irons made rigid by lattice-work, and sustained by steel stay bars at the top of the turning mast.

There are on each crane three 110-volt continuous-current motors. One motor of 8·3 H.P. actuates the lifting winch, one of 2·1 H.P. moves the truck along the horizontal jib, and the third of 3·2 H.P. gives the turning movement to the crane. All the motors, winches,



Electrical Tower Crane, Riva Shipyard.

and controllers are in the operator's cabin, fitted under the jib, and are under his immediate control. As the three movements are independent, they can be made together, thus reducing waste of time in manœuvring.

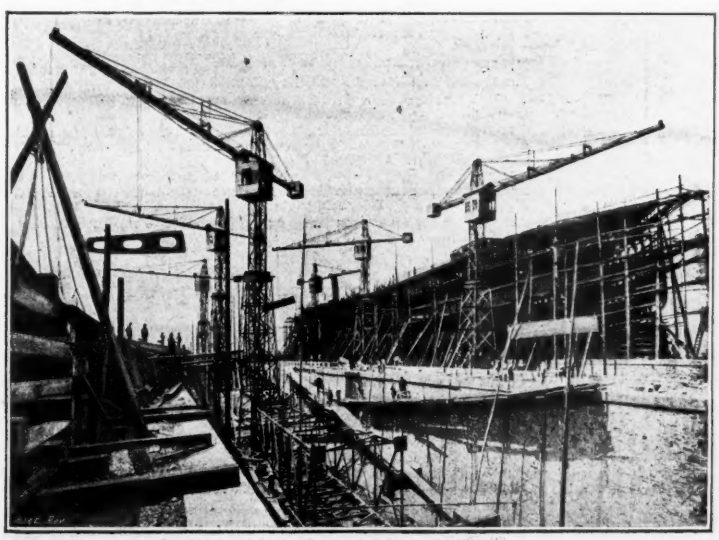
Energy is conveyed to the motors from the bases of the cranes by bronze rings and copper brushes. The short arm of the horizontal jib carries a counterweight, which has been calculated in such a way as to counterbalance a weight of 750 kilos (half load) at the end of the jib.

The principal features of the cranes are:—Safe load, 1·5 tons; height of horizontal jib, from 69 ft. to 82 ft.; lifting speed, 50 ft. per min.; travelling speed of the load truck, 92 ft. per min.; and turning speed at the extremity of the jib, 400 ft. per min.

A railway well away from all interference on the external side of each lateral berth is sufficient for the three berths, as the working radius of the cranes exceeds the maximum breadth of vessels building. Practically, the cranes have, alongside the outer berth, a far greater range than that given by the jib's length, as a load can be hoisted lying far away from the ground covered by the jibs.

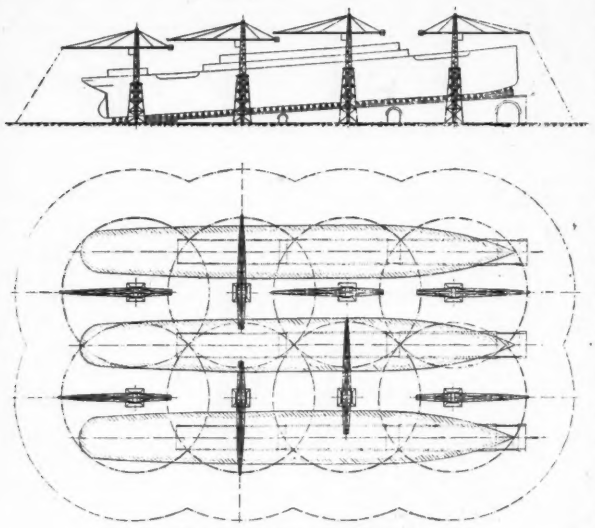
Three years' working experience has proved the excellence of this equipment, and so far the expenses in upkeep are limited to the changing of steel wire ropes, an outlay of a few pounds; further, the safe load of 1·5 tons per crane has proved sufficient in all general cases.

The author then indicates an ideal equipment of three berths for ships of, say, 460 ft. long, with berths spaced 100 ft. between centre lines, and eight cranes, each of 2½ tons lifting capacity, in two rows of four in each. All the cranes should have a working radius of 82 ft., and three independent motors, one for lifting, one for moving the truck load, and one for turning the crane; the speed of the motions being as follows:—Lifting speed, 80 ft. per min.; horizontal speed, 95 ft. per min.; turning speed at the extremity of the jib, 400 ft. per min. The vessels on the side berths are not entirely covered by the turning jibs; but this is of no importance in practice. The ground area practically covered by the cranes is far greater than that limited by



An Italian Shipbuilding Berth, with Electrical Crane Equipment.

the jibs' length, as by allowing the hoisting rope to assume an inclination of, say, 30° with the vertical, weights up to 2 tons lying about 130 ft. from the centre of the crane can be safely handled. The yard area occupied by the cranes is very small. The towers can be utilised for the installation of water pipes, compressed air and electric mains for use on the berths. The total cost of such an installation is about £10,000, foundations included; or for a two-berth equipment, £6,600.



ELEVATION AND PLAN OF BERTHS.

The author concludes with the following comparative table of costs of various types of installation:—

Type.	Cost, including foundations.	Annual expense taken at 16 per cent.	Labour saved over old mast or derrick system.	Gain.	Loss.
1. Cantilever type	£11,500	£1,840	£1,720	—	£120
2. Cantilever with addition of two side cranes ...	14,800	2,368	2,580	£212	—
3. Lattice pillars with skeleton roof carrying three travelling cranes over each berth...	28,500	4,560	2,580	—	1,980
4. Lattice pillars with glazed roof, saving time in bad weather ...	32,000	5,120	2,838	—	2,282
5. Lattice pillars with connecting girders, carrying one large travelling crane for each berth ...	26,050	4,200	2,660	—	1,540
6. Tower crane, two cranes per berth, equal to four cranes on permanent ways ...	11,900	1,904	2,660	756	—
7. Tower cranes, Riva type ...	6,700	1,072	2,660	1,588	—

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

10,457. "Internal automatic device for controlling the operation of Cummin's sanding apparatus for use on electric tramway and railway vehicles." R. DODD. May 6th.

10,469. "Improvements in and relating to electrical vapour apparatus." K. HAHN. May 6th.

10,470. "Improvements in the method of and means for connecting electrical vapour apparatus with the conductors." K. HAHN. May 6th.

10,477. "Connection for two or more ways of sounding motor horns, electric or otherwise." B. G. NARISCHKINE. May 6th.

10,506. "Improvements in multiple carbon arc lamps." J. BROCKIE. May 6th.

10,513. "Process of protecting the support of arc lamps with laterally supported electrodes." H. BECK and DEUTSCHE BECK-BOGENLAMPEN-GES.m.b.H. (Date applied for under Patents Act, 1901, May 5th, 1906, being date of application in Germany.) May 6th. (Complete).

10,514. "Improvements in electrodes." J. H. ROBERTSON and J. C. KLAIZL. May 6th. (Complete.)

10,518. "Improvements in magnet boxes and armatures of magnets therein.' C. D. LANNING. May 6th. (Complete.)

10,522. "Improvements in pocket magnetic compasses." S. S. LAWRENCE. May 6th. (Complete.)

10,537. "Improvements in telephone transmitters." S. C. HOUGHTON. May 6th. (Complete.)

10,560. "Improvements in or relating to electrically-controlled railway block signalling and apparatus therefor." P. BROWNE. May 6th.

10,579. "Manufacture of sodium by electrolysis." G. T. BEILBY. May 7th.

10,597. "Improvements in and relating to apparatus for automatically operating electric switches for starting and stopping electrically-driven pumps." J. TAYLOR. May 7th.

10,625. "Improvements relating to the electric transmission of images." F. VON MADALER. May 7th.

10,636. "Improvements in electric traction installation using contact boxes." P. B. BLACK and T. H. BLACK. May 7th.

10,638. "Improvements in coherers suitable for use in wireless telegraphy." R. J. CROWLEY and A. W. SOMERS. May 7th.

10,639. "Improvements in wireless telephonic apparatus." R. J. CROWLEY and A. W. SOMERS. May 7th.

10,640. "Improvements in autographic telegraphs." R. J. CROWLEY and A. W. SOMERS. May 7th.

10,641. "Improvements in or relating to leakage detectors for surface contact electric traction systems." E. A. MITCHELL. May 7th.

10,650. "Improvements relating to electrical apparatus for transmitting and receiving signals." A. T. DAWSON and G. T. BUCKHAM. May 7th.

10,662. "Arc lamp." C. C. WINTHER-HANSEN and P. BOUCHSEIN. May 7th. (Complete.)

10,665. "Improvements in and relating to switches, fuses and the like." BRITISH THOMSON-HOUSTON CO., LTD. (Allgemeine Elektricitäts Ges., Germany.) May 7th.

10,666. "Improvements in and relating to electric switches." BRITISH THOMSON-HOUSTON CO., LTD. (Allgemeine Elektricitäts Ges., Germany.) May 7th.

10,687. "Improved electrical block signalling system for railways." G. H. BROWN. May 8th.

10,694. "Improvements in systems of insulation for high-potential electric conductors." F. M. LOCKE. May 8th. (Complete.)

10,699. "Improved pitch product for insulating electric cable trenches, and for use for other purposes." T. MARRIOTT. May 8th.

10,709. "Improvements in electro-magnetic brakes for railway and other vehicles." R. BRAUN. (Date applied for under Patents Act, 1901, May 18th 1906, being date of application in Germany.) May 8th. (Complete.)

10,719. "Improvements in and relating to electric motor starters." A. H MAYES and FERRANTI, LTD. May 8th.

10,742. "Improvements in wireless telephony." A. S. WARWICK. May 8th

10,786. "Improvements in and relating to signalling systems and apparatu therefor." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 8th.

10,837. "Improvements in fittings for gas, electric and other lights." M. STERN. May 9th.

10,827. "Improvements in or relating to systems for working electric motors for the driving of machinery and for analogous purposes." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke, G.m.b.H., Germany.) May 9th. (Complete.)

10,855. "Improvements in the method of and means for producing ignition of explosive mixture in explosion motors." M. DELAGE and P. WOOG. (Date applied for under Patents Act, 1901, May 9th, 1906, being date of application in France.) May 9th. (Complete.)

10,861. "Improvements in direct-current armatures with multiple circuit winding." F. PUNGA. May 9th. (Complete.)

10,931. "Improvements in incandescent lamp bulbs." D. F. CAMPBELL. May 10th. (Complete.)

10,936. "Improvements in arc lamp brake and focusing gear." J. BROCKIE. May 10th.

10,943. "Improved means for connecting up electric cables." R. BROWN. May 10th.

10,955. "Improvements in telephone switch operating mechanism." F. M. POTTER, jun. (Date applied for under Patents Act, 1901, May 28th, 1906, being date of application in United States.) May 10th. (Complete.)

10,969. "Improvements in repulsion electric motors." FELTEN AND GUILLEAUME-LAHMEYER-WERKE ACT.-GES. (Date applied for under Patents Act, 1901, May 14th, 1906, being date of application in Germany.) May 10th. (Complete.)

10,972. "Improvements in or relating to insulators for electric conductors." PORZELLANFABRIK KAHLA, FILIALE, Hermsdorf-Klosterlausnitz. (Date applied for under Patents Act, 1901, May 14th, 1906, being date of application in Germany.) May 10th. (Complete.)

10,979. "Improved method of current regulation in electric installation in which storage batteries supplement the generator." O. SCHALLER. May 10th. (Date applied for under Patents Act, 1901, May 14th, 1906, being date of application in Germany.) (Complete.)

10,993. "Improvements in the electric lighting of specula." S. KAPLAN and E. BATAULT. May 11th. (Date applied for under Patents Act, 1901, May 14th, 1906, being date of application in France.) (Complete.)

10,996. "Improvements in arc lamps." H. E. MOUL. May 11th.

11,044. "Improvements in electric cables and the bonding thereof." A. E. TANNER and E. A. CLAREMONT. May 11th.

11,066. "Improvements in dynamos for train lighting." H. LEITNER. May 11th.

11,070. "Improvements in and relating to switch mechanism for controlling electric motors." BRITISH THOMSON-HOUSTON CO., LTD. (Allgemeine Elektricitäts-Ges., Germany.) May 11th.

11,071. "Improvements in and relating to electrically operated winding gear." ALLGEMEINE ELEKTRICITATS-GES. May 11th. (Date applied for under Patents Act, 1901, May 12th, 1906, being date of application in Germany.) (Complete.)

11,072. "Improvements relating to plates for electrical accumulators." M. MARGULIS. May 11th. (Complete.)

PUBLISHED SPECIFICATIONS.

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1906.

ELECTRIC ROTARY CONVERTERS. J. L. Murdock. 9,606. April 24th.

X-RAY APPARATUS. M. Levy. 9,089. April 17th.

ELECTRIC FUSIBLE CUT-OUTS. E. Schattner. 13,600. June 13th.

ELECTRO-DEPOSITION OF COPPER. S. O. Cowper-Coles. 13,972. June 18th

ELECTRIC INCANDESCENCE LAMPS. W. Nernst and L. Stockem. 15,951. July 13th.

ELECTRIC FURNACES. F. E. Roach. 26,929. November 27th.

HAND TELEPHONES. S. C. Houghton and P. M. Potter. 28,227. December 11th.